The Impact of Modern Information Technology on the Structure of Military Intelligence Organization at the Tactical Level

by

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I. INTRODUCTION

The rapid technicological progress of man during the twentieth century in nearly every field has been increasing at an exponential rate. Despite providing increased capabilities and solving long term problems of the past, nearly every new invention brings with it new problems of application and control. Frequently, those problems are ignored or put aside for later consideration (e. g. the atomic bomb in 1946), only to surface again at most inconvenient times. In the race for progress, it is relatively easy to get so involved, that people, organizations, and even nations can lose perspective.

The arms race, or attempt at maintenance of military superiority (or at least parity), is a prime example of the "progress at all costs" syndrome. This thesis seeks to examine one small area of progress under the military umbrella. The area chosen is that of the automated information system in the context of how it effects the organization and structure of the author's branch of service, the Military Intelligence Branch, United States Army.

There is a definite need to examine the so-called state of the art of integrating modern information technology into the Military Intelligence Corps. An area exists where perspective may have been lost for a time as the MI reacted somewhat like a sixteen-year-old boy suddenly confronted with the use of a 400-horse-powered sports car, while he is just learning to drive.

The Military Intelligence Branch, as the operating arm for intelligence within the Department of the Army (DA), is concerned with a variety of missions including DA strategic requirements levied by the Defense Intelligence Agency (DIA), counterintelligence, technical intelligence, and tactical intelligence support to the combat arms. It is in this latter area that this thesis places emphasis. There are three reasons for this. First, the primary mission of any combat support branch, such as Military Intelligence, is support for the combat arms and therefore this mission should receive priority consideration. Second, the division, as the typical tactical level command, develops intelligence support requirements which are not so great as to overwhelm current information system capabilities; nor are these requirements so small as to not require automated assistance at all. Third, sufficient experimentation has been undertaken with ADP hardware at the division level to permit an evaluation of the state of the art, since the division was the level selected for the first operational Army intelligence subsystem.

Why This Thesis?

The thought of writing on this subject first occurred to the author in Headquarters, Military Assistance Command Viet Nam (MACV) during his service as a Staff Intelligence Officer from November, 1966, through November, 1967. At that time the Army attempted to apply a great many research and development ideas to the combat environment with varying degrees of success. There was sufficient opportunity for an officer in MACV to visualize the enormous potential that existed in the R&D or prototype items arriving every day. Some of them provided immediate help and received a certain amount of publicity such as the SLAR (side

looking airborne radar), and the celebrated "people sniffer". Other items arrived with a great deal of fanfare, but never justified the initial high hopes. Most of these items are classified either in hope that they can be revived or out of general embarrassment of all concerned. These latter items provided an opportunity for frustration equally as great as the self-satisfaction obtained in the successful cases.

One of the items which fell in neither the highly successful or the complete failure category was the computer. Success stories abound about the computer in Viet Nam, but these are at the operational or "nuts and bolts" level, primarily in the areas of logistics and personnel management. Success in these areas had been achieved before Viet Nam. The frustrations factor came to those anticipating a breakthrough at the management level in either operations or intelligence. It, on occasion, seemed so close, but at other times it appeared at the end of a thousand mile tunnel.

It occurred to several of the officers in the intermediate staff ranks that this area was one of those where continuous technical progress had clouded individual perspective. Perhaps, it was time to stop and take a look at the situation as objectively as possible.

Initially this thesis was designed to examine the impact of current and future information systems technology on the military intelligence structure at the tactical level. The author had no specific objectives in mind. However, as the research progressed and the author widened his own perspective during his studies at Wharton School of Finance and Commerce, it became apparent that certain problem areas did stand out and that possible solutions existed to solve or alleviate some of these problems. Therefore, the problem was redefined to include the words

"with the objective of isolating present and potential bottlenecks to progress which might be resolved within the military intelligence structure"

The Approach

This examination of the impact of information systems on the Military Intelligence structure has been divided into four parts (Chapters II through V). In Chapter II, the role of intelligence is examined during the emergence of modern warfare. A trained intelligence officer reader will find that this chapter is familiar in content to some classes he may have had at service schools, but to anyone out of the field, it is always a great surprise to learn just how far the art has come in such a short period, at least in regard to its recognized value.

Chapter III follows the emergence of automation in the armed services. Fewer readers will find this chapter to be familiar because so few members of the military have data processing experience and fewer civilian data processing specialists have worked in military intelligence.

The inevitable meeting of a demanding master, military intelligence, and an equally demanding mistress, automated systems; is discussed in Chapter IV, primarily using the vehicle of the first detailed research and development tactical command and control system. At this point it was possible to isolate problem areas and these are dealt with individually in Chapter V.

Chapter VI adds no new information or ideas, but attempts to derive conclusions and specific recommendations from a more concise look at the problem in a purely military format.

This thesis is not heavily footnoted, although whenever possible

authorities are provided, primarily to permit the reader to explore an area more completely if he is so inclined. A great deal of comment and of the ideas presented in problem solutions are from the author's personal experience. This experience has involved both operational and staff aspects of intelligence covering the last eight years of a seventeen-year military career.

There is no contention that anyone reading this thesis and following its recommendations will suddenly see all the problems melt away and a smooth running, highly efficient operation ensue. It is hoped, however, that the reader will be aided by this thesis in regaining the necessary perspective in viewing the situation and thereby be able to apply the recommended solutions or develop some of his own.

Abbreviations

The reader may not be entirely familiar with the vast use of abbreviations by the United States government. Although abbreviations are spelled out in this thesis, on their initial appearance throughout the paper, an alphabetical listing is provided here to permit rapid indexing if an abbreviation's meaning is needed later in the paper.

AAA	Anti-aircraft Artillery
ADP(S)	Automatic Data Processing (System)
ADSAF	Automatic Data System (Army in the Field)
ASA	Army Security Agency
CCIS	Command Control Information System
CIA	Central Intelligence Agency
CIC	Counterintelligence Corps
CONARC	Continental Army Command

CORG	Combat Operations Research Group
CSCC	Combat Support Command and Control
DA	Department of the Army
DIA	Defense Intelligence Agency
DMZ	Demilitarized Zone
EEI	Essential Elements of Information
ENIAC	Electronic Numeric Integrator and Calculator
FBI	Federal Bureau of Investigation
FDC	Fire Direction Center
FICEUR	Fleet Intelligence Center Europe
G	General Staff Abbreviation
G-2/AIR	Assistant G-2 responsible for exploitation of aerial collection means
IBM	International Business Machine Corporation
ISUM	Intelligence Summary
J	Joint Staff Abbreviation
JCS	Joint Chiefs of Staff
MACV	Military Assistance Command Viet Nam
MBA	Master of Business Administration
MI	Military Intelligence
NORAD	North American Air Defense Command
NVA	North Vietnamese Army
OB	Order of Battle
OSS	Office of Strategic Services
PCM	Punched Card Machine
PIR	Periodic Intelligence Report
QMR	Qualitative Material Requirement

R & D	Research and Development
RCA	Radio Corporation of America
RVN	Republic of Viet Nam
S	Staff Abbreviation-- below General Level
SAC	Strategic Air Command
SAM	Surface to Air Missile
TIIF	Tactical Imagery Interpretation Facility
U & S	Unified and Specified
USACDCINTA	United States Combat Developments Command Intelligence Agency

II. THE ROLE OF INTELLIGENCE DURING THE EMERGENCE OF MODERN WARFARE

When an individual attends an intelligence school operated by the military or even an intelligence course in some other military school, he can count on receiving the inevitable introductory motivation lecture. The lecture traditionally includes the information that intelligence is one of the world's oldest professions. It also passes on that the earliest written record of an intelligence action occured when Moses sent scouts into Canaan to spy out the land. The lecture is usually interspaced with Confucius style quotations allegedly made by the legendary General Sun Tzu. The quotations, of course, all recognize the value of good intelligence. The lecture usually continues with an explanation of current intelligence missions, functions, organization, and techniques. In order to understand the impact of modern technology on military intelligence, the reader should be familiar with how the military intelligence role has developed through modern history. Every generation since the industrial revolution has witnessed the cataclismic changes throughout the military. This chapter proposes to outline the development of military intelligence up to the advent of computer automation.

The Beginning of Intelligence as a Military Art

All the motivation lectures to the contrary, intelligence was not considered the most important factor or even a most important factor by most ancient commanders. In the early days the words intelligence and espionage were almost synonimous. The military commander in the days of the Grecian or Roman Empires knew only that about the enemy which his spies found out, added to any previous experiences, which he had encountered or his predecessors had recorded in battle against them. He augmented such

information with a limited cavalry reconnaisance capability. In these early conflicts, the commander, who was frequently also the Chief of State, was often able to personally view the entire battle area which was tightly compacted with massed formations of troops. War was a series of chess moves by two commanders overlooking a battle-field chess board. With allowances for some brilliant tacticians, such as Alexander the Great, and superior forms of tactical doctrine, as evidenced by Rome against her early enemies, the war was usually won by the commander with the largest number of well-trained troops.

Like all other aspects of civilization, war evolved as technical improvements in weaponry were discovered; the development of artillery following the discovery of gunpowder, soon forced the armies to spread out over greater areas of terrain. Their now unwieldy nature became too difficult for one commander and the concept of staff evolved.

As early as 1640, when the famous Prussian army was created by the Duke of Brandenberg, there is a record of the beginning of the German General Staff. The first paysheets refer to the members of the staff as a Commissary General (sort of a combined S-1/S-4), two adjutants General (remnants of a personal staff), a General-Auditor (or military law specialist), a Wagonmaster (Transportation Officer), a Provendermaster (Quartermaster aspects of the S-4). a Master of Ordinance (S-3 or Tactician), and an Enforcer General (responsible for police matters). The staff was headed by either the Master of Ordinance or a countorpart of today's Chief of Staff, called the Quartermaster General.[1]

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1. Goerlitz, Walter; "History of the German General Staff", Praeger, New York, 1953. pg. 3.

Intelligence is not mentioned on this early staff. Presumably it was the responsibility of either the Enforcer or of one of the Adjutants. More important than the responsibility for intelligence at this time, is the development of staff as a concept. First commanders sought to engage specialists to carry out various requirements of command with the inevitable result that some specialization of military officers began to take place. A secondary result fostered the growth of intelligence. As individual staff officers sought to improve their competitive position through assumption of increased responsibility, intelligence on enemy forces provided an excellent vehicle upon which to ride. Nevertheless, as military history progressed through the period up to World War I, examples of good intelligence, as well as examples of bad intelligence, generally depended on only two factors, the capability of the responsible staff officer, and the willingness of the commander to use the intelligence at his disposal. In this regard, the reference is to tactical battle intelligence, not to the more glamorous individual exploits of espionage which take place in every recorded conflict.

Intelligence During the Advent of Modern Warfare

Integrated intelligence, that is the applied use by a tactical commander of agent information, tactical reconnaissance, and open source information, became possible with the advent of improved communications during and after World War I.

Espionage was no longer limited to strategic use if an agent could transmit information in time to affect the current tactical situation. Radio provided the means from behind the line or on the line itself. Aircraft provided a means for rapid reconnaissance which could penetrate far

deeper than cavalry. Wide availability of newspapers, periodicals, and other open sources permitted a more extensive advance build-up of files on potential enemies. The increasing capability to gather intelligence made its use an organic part of military organization.

By the beginning of World War II, the staff of every commander from battalion level up had an intelligence officer and/or section. Great Britain, France, and Germany had sophistocated programs of espionage, aerial reconnaissance, prisoner interrogation, and counter-intelligence deception (to deceive enemy intelligence).

The United States effort was largely an amateur one, with the S-2, or Intelligence Officer, frequently the junior officer in rank or an ineffective commander "kicked upstairs". At the strategic level, the OSS, or predecessor of the current CIA, muddled through the war quite well aided by a wide diversity of foreign born Americans and some very talented "citizen soldiers" such as the late Allen Dulles, later the CIA Director, and Michael Burke, now President of the New York Yankees.

United States efforts were not all bad by any means. Intelligence predicted the war with Japan rather accurately (see Chapter V), and at the tactical level, the intelligence aspects of such well publicized operations (after the war) as "Overlord" (the invasion of Europe) and the North African campaign were as laudable as any during recent history. By the end of the war, United States aerial reconnaissance was the most sophisticated in the world. Behind the line operations with partisans in the Philippines were also highly successful. At the opposite extreme, Naval Intelligence searched the country for months trying to find anyone who had ever set foot on the Island of Tarawa. Japanese forces were consistently over-rated in the later phases of the war, and German jet aircraft caught our forces by surprise.

Intelligence After World War II

By the end of World War II, the United States military establishment was fully aware of the importance of both the strategic and tactical level of intelligence, regardless of the diverse examples of quality of performance. The Cabinet reorganization of 1947 included formation of a permanent strategic intelligence organization, the Central Intelligence Agency. Both the Army and Navy as well as the newly formed Air Force had their own intelligence organizations. In recent years overlapping responsibilities in service intelligence areas have been greatly reduced by the creation of the Defense Intelligence Agency. DIA was subordinate to the Department of Defense and responsible for providing intelligence support to the Executive branch (in specified areas), the Defense Department, the Joint Chiefs of Staffs, the Unified and Specified Commands (encompassing multi-service responsibility) and the individual services in areas of multiple interest. At the Army tactical level, tables of organization called for the G-2/S-2 as before, but now some attention was being given to training the man in the job. Although at the battalion or regimental levels, the post of S-2 was still an "undesirable" career position, the Army now had detailed specialist officers in the intelligence field at higher staff levels. A military intelligence branch was finally authorized in 1963 together with its own school system and career development opportunities.

The Role of the Intelligence Officer (Estimate of the Situatio ,

What has been the role and what have been the procedures followed by the "modern" intelligence officer, operating manually before any attempted integration of computers or other highly automated equipment? For

consistency, operations at the division level have been used. They include most of the aspects of those levels immediately above and below (Corps and Brigade). As was indicated in Chapter I, the division was the prime area of interest in the first intelligence information subsystem, thereby permitting a comparison of pre-automated and automated operations at the level where computer support appears feasible.

Since the staff officer is an extension of his commander, one must first study the commander in order to perceive the role of the staff officer. The Division Commander, having received a mission from higher headquarters, or having deduced one from general guidance and his own situation, formulates an Estimate of the Situation. The form and sequence of the Estimate are prescribed, but the situation and necessity for a rapid decision may modify it. Following a statement of the Mission, four additional headings are included. The situation, viewed in a general sense, included "all elements and aspects affecting operations in order to facilitate development and analysis of feasible courses of action to accomplish the mission."[2] The facts analyzed pertain to environment, resources available, and actual or potential obstacles or opposition to success of the mission. Courses of action are formulated so as to answer the standard interrogatives--what (type action), when (to begin and to be completed), where (location of the area of operations), and how (methods of resources employment). Obviously inferior courses of action are discarded, but those with potential are retained for analysis. The next step involves an analysis of the opposing courses of action, in which each

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2. F. M. 101-5, Hq. Dept. of the Army, Washington, D. C. 1960, pg. 56.

course of action listed is analyzed as to its probable outcome when opposed by the major difficulties noted in the situation. The commander next compares his own courses of action noting significant advantages and disadvantages either by course of action or by a series of sub-headings, such as terrain, enemy capabilities, etc. In either case, he makes a decision based on that course of action offering the most significant advantages and the best chance of success.

It is obvious that for a detailed operation, the commander would be burdened down with work doing the Estimate by himself; therefore, he is aided by a series of Staff Estimates. Personnel (G-1), Intelligence (G-2), Operations (G-3), Logistics (G-4), and sometimes other staff officers prepare input estimates.

The Intelligence Officer's Estimate attempts to determine the capabilities (and priorities of adoption when appropriate), the exploitable vulnerabilities of an actual or potential enemy, and also the effects of the area of operations on friendly courses of action.

The Intelligence Officer's Estimate is prepared in a slightly different format than that of the Commander. Commencing with a statement of the mission, it next deals with the Area of Operations under the headings of weather, terrain, and other characteristics, such as sociology, economics, or politics. Each heading is discussed in three components; the existing situation, the effect on enemy courses of action, and the effect of friendly courses of action. The Estimate now breaks down the Enemy Situation dealing with his dispositions, force composition, strength (committed, potential reinforcements, and support), recent and present significant activities, and peculiarities, and weaknesses (grouped under staff headings: G-1 through G-5 and including personality information on

on enemy commanders, if known). The next step involves an analysis, of each enemy capability, if possible from the enemy point of view. Finally, conclusions are presented, based on all the previous information and analyses. These conclusions are stated as to the total effects of the area of operations on the friendly courses of action, the courses of action most probable of adoption, and the effects of enemy vulnerabilities which may be exploited.

The Commander and Staff Estimates are most important documents as they are the basis for making decisions. As such they actually provide the core of subsequent Operations Plans and Orders, with appropriate Staff Annexes. The Intelligence Officer is primarily concerned with advising his commander so as to aid the correct decision rather than the subsequent implementation of that decision. Therefore, a great deal of descriptive time has been spent on the Estimate. An example of a Division Intelligence Estimate is attached as Appendix #1 to this paper.

The Role of the Intelligence Officer (Other Duties and Organization)

The Division G-2 has far more duties than the preparation and maintenance of an intelligence estimate (in fact, most G-2's prepare a current estimate and keep it up to date rather than start over for each mission). He is responsible for Production of Intelligence, including: preparation of plans and orders for collection of information including target acquisition; combat surveillance; air reconnaissance; supervision and coordination of weather data; supervision and prediction of fallout from enemy nuclear weapons; integration of intelligence information provided by other command elements; processing of information into intelligence; and recommending essential elements of information (EEI or current knowledge

gaps) to the commander. The G-2's responsibilities for Use of Intelligence and Information encompass both his preparation of the Estimate and appropriate annexes to Orders and Plans. They also include timely dissemination of available intelligence and information to higher, lower, and adjacent commanders by the most appropriate means. He has a Counter Intelligence mission to direct the security effort against enemy espionage. Finally, the G-2 assists in such miscellaneous duties as the intelligence aspects of guerilla activities, psychological warfare, employment of mass destruction weapons, barrier and denial operations, and deception operations.[3]

The G-2 of an Army Division should be an experienced Lt. Colonel with an intelligence background, if he is a Combat Arms Officer, or have wide experience with combat arms if he is a Military Intelligence Officer. He is provided with an Assistant G-2 (Major), a G-2/Air (Major or Captain), and an Intelligence Senior Non-Commissioned Officer, but his principal help comes from the Division Military Intelligence Detachment which is attached to provide those skills necessary to deal with the techniques of photo-interpretation, prisoner of war interrogation, and enemy order of battle. The current detachment is authorized seven officers and fourteen enlisted men, while a proposed augmented manual system (because of increasing workload) would authorize eight officers and fifteen enlisted men.[4]

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3. Op. Cit. FM 101-5, pg. 23.

4. Alderson, Donald J.; Brush, Leonard M.; Combs, Carlton E. Jr.; and Hall, Donald L.; "Cost Effectiveness Analysis of the Proposed Intelligence Sub-system of CCIS-70", Fort Belvoir, 1964, pg. 41.

The Role of the Intelligence Officer (The Progressively Increasing Workload)

The techniques involved in processing intelligence by a manual system include maintenance of a series of documents. These include an Intelligence Journal (daily activities log), an Intelligence Worksheet (usually formated as a loose-leaf Estimate), Order of Battle Card Files, Personality Files, Situation maps, and other assorted and sundry documents depending on the situation and the personality of the G-2. The report requirement alone requires that many of the personnel be largely involved with processing paperwork, either by entering data, or preparing an estimate or annex from the data. In a trench war such as World War I, or even in a "major campaign" conflict such as World War II, the G-2 had time to painstakingly prepare his intelligence for dissemintation to the field. His estimate for the commander was readily updated. When a mistake occurred, United States manpower usually made up for the difference, and "after all, the percentages were with him". The possibility of nuclear war or even conventional war with more destructive weapons makes a repeat of this past situation unlikely.

During the author's training at Fort Holabird, Maryland (The Army Intelligence School) he had accession to role-play the G-2 and several of his assistants on a rotating basis during a simulated exercise for several days. The G-2 team found themselves having little difficulty keeping up with the "canned" data involving a rewritten World War II campaign with a few tactical nuclear weapons thrown in to "modernize" it. Some of the students no doubt wondered what would happen if a major information breakthrough (such as availability of a large group of prisoners or sudden good weather permitting a mass of photography) occurred at the same time the commander got crash orders for a new campaign, and

the enemy had mounted a major deception operation. Experts studying the manual system for cost effectiveness estimated a 268% overload could occur during a peak hour and further estimated that the division has an 87% service level capability for processing the daily message load at full strength.[5] These figures were developed in 1963-64 before the availability of some newer collection techniques; so it is probably a safe estimate that the 87% figure today would be high and the 268% figure would be conservative.

During the author's 1966-67 tour in Viet Nam he observed a manual intelligence system attempting to deal with a highly fluid war under most unfavorable conditions when he spent some time with the newly formed Americal Division in Chu Lai. In Viet Nam, operations were largely decentralized to brigade and battalion level and the Division G-2's primary function was to provide intelligence support. The Americal G-2 staff members averaged 18 hours work per day trying to build a data base on their new area, process information coming in from three brigades and/or ten battalion S-2's, provide processing for and dissemintation of photography coming from the Division Aviation element, provide estimates and briefings to the division commander for the daily requirements, and to satisfy EEI from both their Marine Headquarters in I Corps area and MACV Headquarters in Saigon. The reader may note that there were no requirements for preparation for a divisioned level campaign or any crash adjustments to major enemy deployments. Had either occurred, the Division G-2 would have had to set priorities and ignore some of his lower rated activities.

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5. op. cit. Alderson, D. J. and others

Fortunately, technological developments which foster new problems, usually provide, in time, possible solutions. At the same time that super-rapid communications, and aerial surveillance capabilities such as infra-red, side-looking radar, and high-speed photography were beginning to inundate the G-2 and his staff, parallel technical advancements in data processing were uncovering, what was hoped would be the solution to holding back the flood.

It is this proposed solution, automation, and its evolution, that is examined in Chapter III.

III. THE EMERGENCE OF AUTOMATION IN THE MILITARY SERVICE

Early History of Mechanical Data Handling

The Armed Forces have been using information and processing data since "the shot heard round the world" at Lexington, Massachusetts in 1775. Early recordkeeping took the form of pen and pencil entries in ledgers, account books, and muster rolls. Documents available in the National Archives show events as late as World War II being hand written in books of record, even though the typewriter made its appearance in the military about 1890 and the adding machine followed a few years later.[1] Through World War I and well into the middle 1930's these tools, together with mimeograph machines, which came into use at the end of World War I, represented the art of mechanized data processing. Until war came to Europe in 1939, almost all recordkeeping and reporting was done by manual means. Prior to United States entry into the war, their services had started to use comptometers, addressograph, and other newer office equipment.[2]

In early 1940 it became apparent to the Army that with rising administrative workloads, new methods of processing data had to be explored. The concept of processing data faster with Punched Card Machines (PCM) was studied and soon approved. A vast program of converting from manual to mechanical methods of data processing followed. The use of PCM was general

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1. Herbold, J. E. Jr. Colonel: "The Marine Corps Data Processing Program, An Evaluation", Washington, D. C., ICAF, 1963. pg. 6.

2. Ibid, pg. 7.

throughout the Army by war's end.[3]

An interesting technique adopted by the Marine Corps during the early war years was the McBee Keyport system--the "sorting of specially designed edge-notched cards by use of a long needle". In the resulting procedures a personnel specialist recorded, on one of the card forms, a variety of information pertaining to the individual represented by the card. This data described factors related to job skills and individual characteristics. Throughout a series of coded cut-outs around the edge of the card and the use of the needle, personnel officers could select people with specific skills needed to fill job requirements. This procedure represented the first military use of a mechanical record device. The related manpower control system used by the Marine Corps was the forerunner of the more sophisticated techniques that followed.[4]

During the period 1945 to 1956, annual rentals for PCM rose into the millions of dollars; however, this failed to stem the administrative tide. The data processing became more complex and demanded faster and more sophisticated methods of processing data.[5]

Early History of Automatic Data Processing

In 1954, the Army Adjutant General directed that a study be made of his machine records (PCM) system in the Pentagon. With an

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3. Sherron, Gene T., Lt. Colonel: "A Synthesis of Army Officer Education in Automatic Data Processing," Washington, D. C., George Washington Press, 1968, pg. 12.

4. op. cit. Herbold, pg. 6.

5. U. S., Congress, House, Committee on Post Office and Civil Service, Use of Electronic Data Processing Equipment, Hearing before the subcommittee, 88th Congress, 1st Session, 1963, p. 70.

objective of improving the existing system, some attention was given to a comparatively new technology of the time--the electronic digital computer. The only computer being operated by the Army in 1954 was the Electronic Numerical Integrator and Calculator (ENIAC) installed at the Ballistic Research Laboratory, Aberdeen Proving Ground, Maryland. It had been in use since 1946 to compute complex firing tables.[6] The Adjutant General study produced another study with a purpose of examining the feasibility of using Automatic data processing to accomplish the administrative functions of the Adjutant General in the Pentagon. Several months of study included RCA and IBM manufacturer orientations, and on site examination or private industry applications. The study recommended that the Adjutant General "proceed with caution in obtaining a computer system."[7]

The request, upon staffing by Department of the Army, became the subject of branch and staff agency competition for the staff supervisory responsibility over the acquisition of computers. The responsibility was assigned to the Chief of the Signal Corps. In April, 1956, the Assistant Secretary of Defense for Financial Management finally approved the Adjutant General's request to computerize their administrative operations in the Pentagon, and in April, 1957, the computer was declared operational.[8]

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6. Packard, Donald F., Lt. Colonel: "The Long Range Impact of ADPS on Headquarters, Dept. of the Army", Carlisle BKS, Pa.; USAWC, 1955, pg. 8.

7. U. S., Dept. of the Army, "Application of Electronic Data Processing Machinery to the Adjutant General's Office Functions--Second Interim Report", Washington, D.C., August 17.

8. op. cit. Sherron, pg. 14.

The Adjutant General, however, had lost the title of "pioneer of business type computer systems in the Army." During this same time frame, the United States Army Signal Supply Agency, in Philadelphia, Pennsylvania, was also studying the feasibility of converting from PCM to ADP. Since it was removed from Washington and not bound by the same staffing procedures, it installed the first business type system within its authorized budget in mid-1956.[9]

The computer had a foot in the Army's door with a total of two in use in 1956. The number exceeded 600 in 1968 and the rate of increase is approaching 100 per year.[10]

The Department of Defense currently operates nearly 2,000 computers and employs over 51,000 people in their use.[11]

The Early Failure to Recognize Problems

The Korean War administrative and logistics paper workload was so immense a problem that the arrival of computers appeared to be the answer to a prayer. Everyone rushed to justify their own computer and they accepted with enthusiasm all the grandiose schemes and concepts put forth by industry, despite the fact that many had been proved by no one. Developing problems were glossed over by pointing out short term results which were undeniably spectacular. Whenever the computer failed to live up to expectations, the defense usually was something like, "don't worry about it, the next generation of equipment will take care of it," and for a while it did.

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9. Sherman, Gerald, Colonel: "Staffing for Automation in the United States Army", Carlisle Bks, Pa. USAWC 1965, pg. 5.

10. op. cit. Sherron, pg. 16.

11. O'Dell, David A., Lt. Colonel USAF: "The Next Generation: Problems and Possibilities in Command and Control for the U&S Commands", Carlisle Bks, Pa., AWC 1967, pg. 2.

The Army policy for education in the ADP field illustrates the "rose colored glass" attitude of the early years. The origin of ADP education can be traced to the feasibility study team formed by the Adjutant General. These men acquired knowledge through orientation visits to manufacturers and attendance at one American Management Association computer conference. With the exception of a short course in ADP offered at the Signal School from 1957, education in the field was largely on-the-job training relying on manufacturer's representation to teach responsible personnel the equipment operation and maintenance. In the fall of 1960, the Adjutant General Corps sent five officers to American University and the University of Arizona to study for MBA degrees specializing in ADP, but there was still no ADP policy on education at the Department of the Army. Neither the first Army Regulation (1-251) in 1962 nor its successor (18-1) in 1966 had any specific policy statements on education.[12]

The Army was not unique in this failing. The lack of computer education was commonplace throughout the Federal Government during the period between 1956 and 1965. Testimony given to Congress in 1963 emphasized six areas needing attention in the various agencies using computers. Education was not mentioned.[13]

In 1963, the attention of Congressional Committees was focused on data sources, measurement of costs, and progress, and the accepted

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12. op. cit., Sherron, pg. 17-19.

13. United States, Congress, Senate, Committee on Post Office and Civil Service, Hearings on the Use of EDPE, 88th Congress, 1st Session, March 1963, pg. 5.

coming concept of the day, "integrated systems". People were still enamored with applications and the installation of computers in their individual activity. Two years later, the Senate Government Operations Committee finally listed education thirteenth in a list of fourteen priority (mostly hardware) items in a 100-page report to the President on the management of ADP in the Federal Government.[14]

At about this time the ADP knowledge gap had [illegible] such proportions in the Army that immediate action was needed [illegible] close this gap. Between mid-1965 and 1967 the castles in the air began to tumble. In a complete about face from the previous ten years, the United States Comptroller General appeared before a Congressional Committee in July, 1967, and stated:

> "In order to improve the coordination and leadership in the field of ADP, accelerated training at all levels of the government is required. The explosion that has taken place in information processing in the past eight to ten years has been so great that all levels of Government will be required if we are to make the most effective use of the new technology in the years ahead.
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> In considering the problems that need further attention at this time, we would stress the following:
> 1. Training at all levels from top management down through systems designers, operators, and users of ADP systems products."[15]

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14. United States, Congress, Senate, Report to the President on the Management of ADP in the Federal Government, 89th Congress, 1st Session, March 1965, pg. 3.

15. United States Congress, House Committee on Government Operation, Hearings on Data Processing Management in the Federal Government, 90th Congress, 1st Session, July, 1967, pg. 6-7.

With this shift in emphasis throughout the government, the Army took steps to close the gap; however, the problems were so involved and complex that most action between 1965 and 1967 was in the area of defining the problem to be solved. Nevertheless, by late 1967 the Department of the Army Board of Review Army Officers' Schools (Haines Board), the United States Continental Army Command Study on Training for Army ADP Systems, and the West Point Seminar for Computer Educators and Directors had all led to conclusions and recommendations acted on by the Army Chief of Staff which finally constituted a policy of ADP education. This policy is referred to in Chapter V when the problem area of personnel is discussed.

The pattern which has just been described in regard to the lack of education and training for completing the transition to a new system (ADP) was in general repeated in all problem areas. Short term results and cost savings generally clouded the thinking of officers and civilians alike; thereby, obscuring problems as they developed.

Army Intelligence in the early 1960's was not guilty of such cloudy thinking. The vision of its personnel had not been obscured. It had no computers.

Intelligence and Computers, the Beginning

The Defense Department through its intelligence agency, DIA, commenced a plan to automate the intelligence data base in 1963 with each unified and specified (U&S) command being tied in to DIA with its own computer, thereby permitting a nearly instantaneous transmission, up or down, of intelligence data. The "Bombing Encyclopedia", a map grid square to target relationship covering the entire world, was fully automated some time in 1965; and some other small files were completed. Nevertheless,

when the author visited several DIA analysts in mid-1966 they were still operating largely on a manual basis since even those files "up on the computer" had long access queues. One subordinate command had complete its Order of Battle Files. The Fleet Intelligence Center Europe (FICEUR), located in Jacksonville, Florida, had managed to place Southern Europe and the Mediterranean Sea area on an automated operational basis. Other commands with a larger quantity of data elements found the job immense. Still by mid-1968 the job was nearing completion, at least for those areas such as Order of Battle which are most useful to transmission between commands.

Army Intelligence, without a branch to fight its battles until 1963, had little opportunity for automation except as a sub-entity of some other system. There was one exception, the Counter-Intelligence Corps (CIC), then an independent command, began a project to automate its security files in a similar manner to the FBI, taking advantage of the FBI's experience. This project evolved into a combined security automated data base to be used by all the services and the FBI.

Tactical intelligence was interwoven with the combat arms requirements. As early as 1961, the military began consideration of integrated systems, that is a series of separate requirements being met by a common data base, frequently using the same hardware. The combat [illegible] had personnel and logistical requirements which were already computerized at higher levels. Fire support coordination and target acquisition presented a similar problem to that already encountered with the Bombing Encyclopedia. Both operations and Intelligence had to deal with Estimates requiring extensive data for their preparation, some of which seemed applicable to

at least computer storage. Overriding the idea was the current mood of 1961-1963, that of extreme optimism, which has already been explained.

The Combat Developments Command began extensive research into a mobile command and control system encompassing all the ADP requirements of a tactical unit. The result published in April, 1963, as a draft proposed Qualitative Material Requirement (QMR) against paragraph 139a(1) of the Combat Developments Objective Guide became known as the Combat Control Information Systems 1970 (CCIS-70). The date 1970 was the proposed date of complete operation. The Director, Operations Research and Experimentation, Headquarters United States Army Combat Developments Command requested the Combat Operations Research Group (CORG) to perform a cost-effectiveness analysis of the proposed Intelligence Subsystem of CCIS-70. Following their completed report of July, 1964, and some modification directed both through testing and the report, the Intelligence Subsystem CCIS-70 received a recommendation for approval and implementation.[16] The partnership of tactical intelligence and ADP was underway. It has proven an unstable partnership with both good and bad days. Despite a series of name changes, reorganization, and seemingly endless failures, the partnership continues and gives promise of improvement with age. Field mobile computers assigned to an intelligence mission were arriving in Viet Nam in 1967. The Intelligence Subsystem CCIS-70 formed the basic building blocks for the current progress being made in intelligence at the tactical level. The history of CCIS-70, its successes, failures and a general evaluation are presented in Chapter IV.

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16. op. cit. Alderson and Others, p. 1.

IV. ARMY INTELLIGENCE AND AUTOMATION: SUCCESS FAILURES AND THE GENERAL APPROACH OF EARLY PLANNERS

Americans have evolved as a people in a hurry. Since Americans seldom are satisfied with a leisurely approach to solving problems, they tenaciously seek and frequently find a short cut solution that less motivated persons would have overlooked. At the opposite extreme of the success spectrum, Americans may worry themselves into an ulcer over a problem to which no shortcut solution exists. The jury is still out on this country's efforts, civilian and military, to shortcut the application of data processing, but a gambler today would most likely bet on the ulcer over the shortcut.

The computer itself is a fantastic shortcut for calculations and storage of facts with rapid retrieval assess. However, one can barely visualize the total potential if a series of computers can be fully integrated up, down, and across, an organizational hierarchy. It is here that the search for the shortcut is underway and it is here that the jury is still out.

System integration was attacked from the bottom up with processes being automated at the operational level. The tactical and strategic levels then wrestled with the problem of what to do with the operational data base to make it meaningful at higher levels.

Another approach was to attack from the top down, the problem there being that the problem frequently became subdivided into such a large mass of systems that original objectives were obscurred.

The two-pronged approach, top down and bottom up, has operated something like the Americans and Russians meeting at the Elbe. When both sides arrived, they found their objectives were no longer the same.

Regardless of some commercial claims to the contrary, the total information system, is not in existance and some of the pioneers in the field advocate investigation of completely new concepts in the area of system, but merely to relate the problem so as to aid the reader in understanding what transpired in the Army during this period.

The Intelligence Subsystem, Command Control Information System (CCIS-70)

It was in the "shortcut" context that the Intelligence Subsystem, CCIS-70, came about as related in Chapter III. The basic references describing the proposed Intelligence Subsystem were the draft QMR[1] and its Coordination Annex.[2]

The draft QMR stated that the Intelligence Subsystem was intended to

> "provide improvements in timeliness, accuracy, completeness, and form of combat intelligence (including enemy, weather, and area of operations) and tactical counter-intelligence".[3]

To accomplish these objectives, the proposed Intelligence Subsystem was to

> "include digital data processing complexes (intelligence

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1. United States Army Combat Developments Command Intelligence Agency, "Qualitative Material Requirement for an Intelligence Subsystem (CCIS), Draft Proposed by QMR", Fort Holabird, Maryland, April, 1963.

2. United States Army Combat Developments Command Intelligence Agency, "Coordination, Annex, Draft, Proposed QMR for an Intelligence Subsystem (CCIS)".

3. op. cit. USACDCINTA, "Draft Proposed QMR", pp. 4-5.

computer centers) and remote input/output stations, all connected by digital data communications links of varying speeds, in addition to normal voice communications. Intelligence computer centers will also be linked to computer complexes of other functional subsystems of CCIS by digital communications when required."[4]

The draft further specified

"an initial Intelligence System in which intelligence computer centers will be located only at division level; however, design of the system will provide for subsequent expansion to include computer centers at corps and field army headquarters, and at headquarters of the field army intelligence group (Author's note: a projected successor to the current Military Intelligence Battalion). Remote input/output stations will exist at selected subordinate headquarters having an organic intelligence staff section S-2 (Author's note: Battalion and above) and at intelligence collection specialist agencies as required. Each intelligence computer center will require a FIELDATA digital computer, a random access mass storage unit, graphic display equipment, input/output devices, and other ancillary equipment to receive, store, process, retrieve, summarize, disseminate, and display information and intelligence essential to the planning and conduct of tactical operations. The Intelligence Subsystem does not alter existing intelligence doctrine nor does it effect command or staff relationships. It assists the commander, his staff, and the headquarters of subordinate units by receiving and storing information, and intelligence; by presenting information and intelligence concerning the enemy, weather, and area of operations in a variety of hardcopy and graphic formats, by accepting intelligence requirements and disseminating new information and intelligence to the commander, staff and subordinate units whose mission might be affected by the new information and intelligence; by automatically preparing file summarization on request; and by other functional subsystems of CCIS. Design of the system will provide manual backup for all automated processes."[5]

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4. Ibid, p. 1.

5. Ibid, p. 1-2.

A USACDCINTA chart showing a typical distribution of ADP equipment within a division under the proposed Intelligence Subsystem is presented in Figure 1 (at the Division Level only the G-2 is represented by Combat I/Order of Battle Section, G-2 Air Station, Counterintelligence Section, and Automatic Data Processing Section). The proposed levels of employment and data flow between elements of the subsystem are indicated in a USACDCINTA chart presented in Figure 2.

The proposed system sought to apply ADP to primarily the recording and dissemination functions with the other functions of the intelligence cycle (see Figure 3) receiving both direct and indirect benefits from the improvement in the primary areas.

With respect to recording the random access storage and retrieval and file summarization capabilities of the Intelligence Subsystem were intended to replace such manual records as the intelligence journal, the intelligence worksheet, and counterintelligence target files. An automatic graphic display was to replace the manually maintained enemy situation map, order of battle map, and other graphic records (at the Division G-2 computer center only). In order to meet the backup requirements, periodic hardcopy records of graphic displays would permit ready revision to manual methods. The computer aid to recording was to also provide automatic updating of all applicable files immediately upon receipt of new information.

The proposed Intelligence Subsystem was to provide for a computer program to examine the topical content of each new piece of information entered into the system, and on the basis of the examination's results, to cause immediate dissemination of the new information to all staff

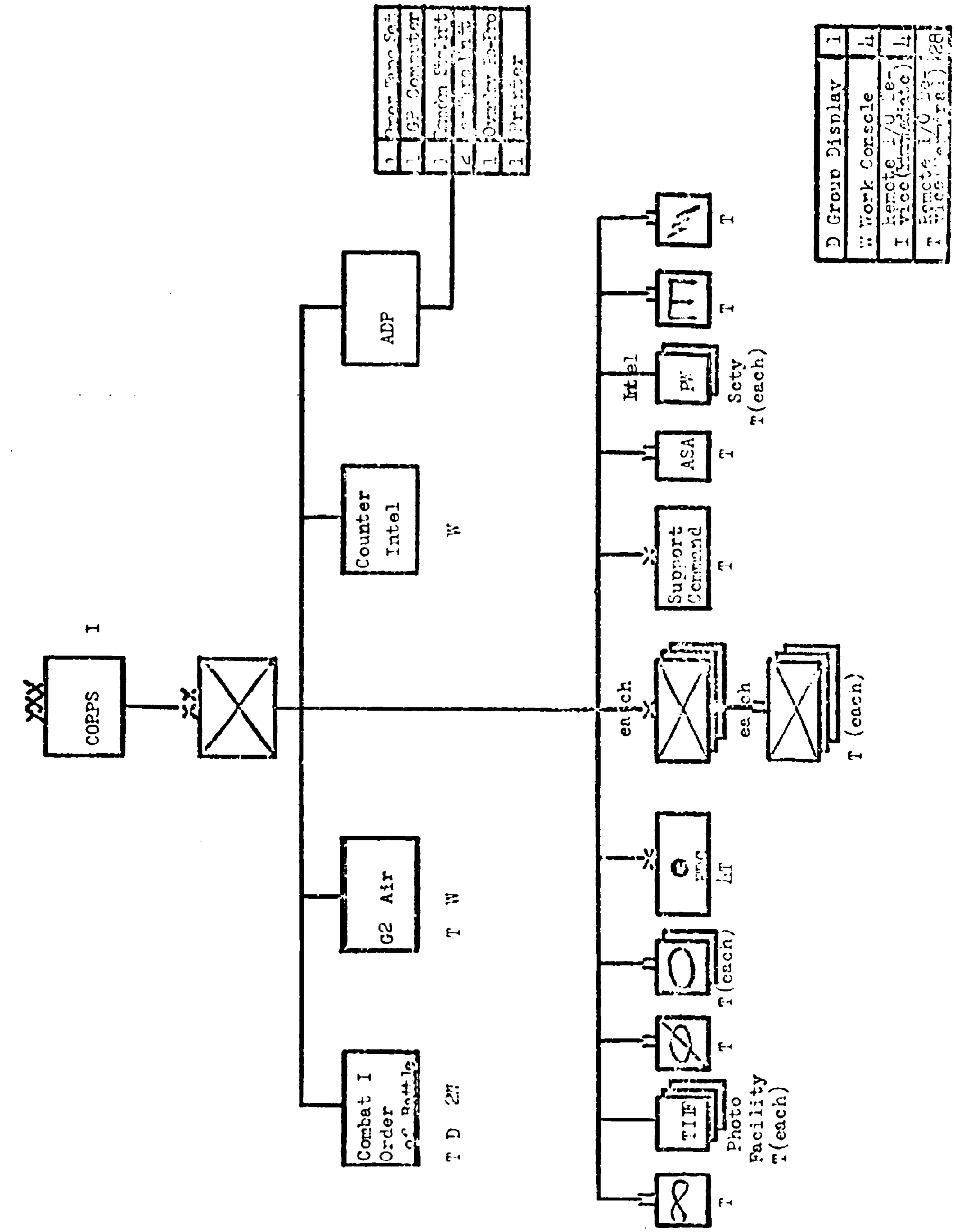

FIGURE 1: Typical distribution of ADP equipment within a division under the proposed Intelligence Subsystem (from USACDINTA charts-1964)

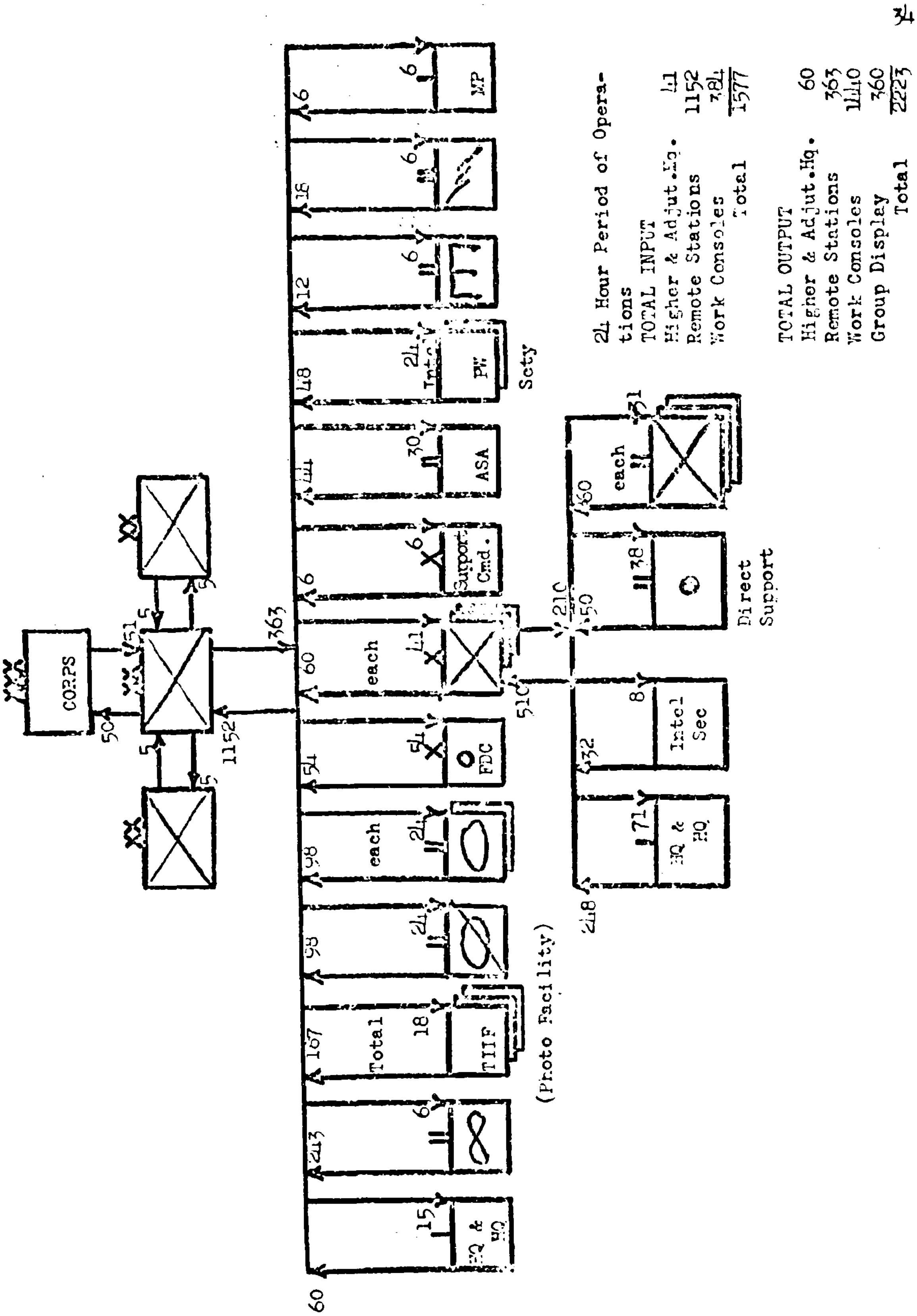

FIGURE 2: Proposed levels of employment and data flow between element of the proposed Intelligence Subsystem (from USACDCINTA Charts-1964)

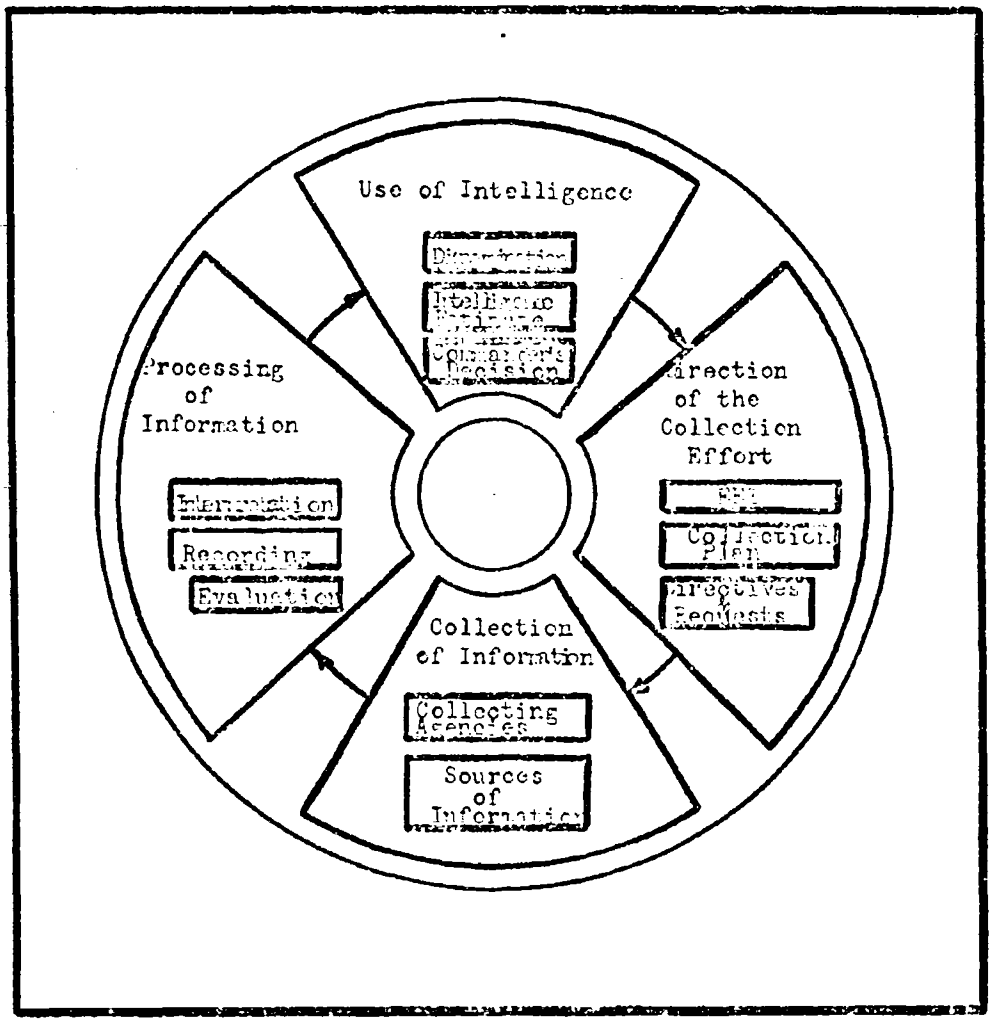

FIGURE 3. The Intelligence Cycle.

sections and higher, lower and adjacent headquarters having an interest in the information.

Another objective in dissemination was to permit response to specific interrogations from users of the proposed subsystem by retrieval from random access storage, summarization where required or requested, and presentation of response in the form requested. Successful achievement of this objective would permit elimination of periodic reports used in the current manual system such as the ISUM (Intelligence Summary) and PIR (Periodic Intelligence Report) since such information could be polled by higher headquarters.

The system sought to organize the collection effort by providing automated distribution of collection orders and requests and recordkeeping associated with responses to such requests. The system was also expected to produce statistics and data for a more complete and efficient evaluation of the collection effort than was possible under manual methods. Although collection itself was not initally considered for automation, the subsystem was intended to provide for rapid acceptance of raw information from all categories of collection agencies operating in support of tactical operations, with provision for intermediate processing for some highly technical or super sensitive input.

Although actual evaluation and interpretation functions were retained as human judgement functions, the performance of these functions was expected to be materially aided by automatic collation, correlation, comparison, and summarization of data, where appropriate. Latitude was left for expansion of the system to included mathematical and statistical analysis techniques as further aids to evaluation and interpretation, if later studies proved them warranted. Additional assistance in the evaluation

and analysis area was expected from the time gained for such duties through assumption of the time-consuming clerical tasks by the computer.

The proposed subsystem was estimate to cost over $200 million (bases on sixteen division army for a ten-year period).[6] This figure compared to an estimated $91 million for maintenance of the Manual System with sufficient personnel to meet the estimated workload over the same ten-year period.[7] The additional cost, therefore, would approximate $100 million, or just under 1% of the costs (investiment plus ten-year operating amortization) of the Infantry Division itself.[8]

The estimated effectiveness of the system might be gauged from figures obtained from early testing. Average message processing time (9.4 minutes per message) was estimated to being reduced 38% to 5.9 minutes.[9] Man hours spent on routine clerical duties over a 24-hour period was estimated as being reduced 65% from 83.7 to 29.[10] Only 31% of the total workload remained manual with the computer assuming 69%.[11] All the above gauges are purely quantitative in nature, and increased quality of processing through reduction of man-made errors could also be expected.

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6. op. cit. Alderson, et al. pg. 21.
7. Ibid, pg. 24.
8. Ibid, pg. 26.
9. Ibid, pg. 31.
10. Ibid, pg. 32.
11. Ibid, pg. 35

The proposed subsystem originally contemplated no changes in the number or types of intelligence specialist personnel at tactical echelons; however, later revisions during the testing period raised intelligence strength from 21 to 24, of which 12 would be non-cross-trained ADP specialists, and 12 would be "orientation type" trained for (ADP) intelligence specialists.[12]

Installation of a new system in a previously system-free environment, as was the case in Infantry Division/Intelligence Subsystem marriage frequently produces unexpected problems. CCIS-70 has had its share, ranging from inability to structure data bases to excessive maintenance problems produced by movement over difficult terrain. The Intelligence Subsystem found its support (as in the previously noted case of personnel) to be inadequate in nearly every area. Increased power generation requirements necessitated augmentation of two 60 kilowatt diesel generators per division ($384,000 over the ten year amortization period).[13] Additional transportation requirements included two additional trucks and trailers per division ($760,160 over the ten year amortization period).[14] The above two figures are related as examples of similar cost increases which occurred up and down the line.

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12. United States Army Combat Development Command Intelligence Agency, "Informal USACDCINTA Revisions to Draft Proposed", QMR, Fort Holabird, Maryland, May 1964, pg. 6.

13. op. cit. Alderson et al. Annex B-Appendix 3, pg. 10.

14. Ibid Annex B-Appendix 4, pg. 17.

Other problems arose in the operational aspects. First, the rapid mobility required of a division was alien to the ADP system's nature. The division's computer center was required to interrupt operations in order to displace. A proposed solution of transferring functions to an adjacent or higher headquarters during displacement proved unworkable. Similarly, in case of a breakdown, the twelve remaining intelligence specialists would be swamped trying to operate manually (about 31% capable by the author's interpolation of figures quoted in Chapter II). Both problems indicate a padding of personnel required and potential expense added to the system.

Another problem, faced by the entire CCIS, was that of enemy detection. Already vulnerable to enemy detection and, therefore destruction, the Division Headquarters increases in size with addition of an information system. The Intelligence Subsystem alone increased the large vehicle total by eight. By adding other subsystems the results were sufficiently staggering to consider combining a series of subsystems (Intelligence, Command & Control Operations, & Fire Support) into one less capable, but less detectable combat support system. Combined with problems in the communications area (basically one of automatic switching relay equipment to handle digital transmissions) and problems occuring outside of the Intelligence Subsystem strata, the high hopes for CCIS-70 began to crack a little.

The reliability of the proposed subsystem was most in question. The array of complicated electronic equipment, vehicles, and communications equipment, as well as additional power generators, presented a distinct reliability problem. The reliability requirements in the QMR appeared

reasonable considering that cost estimates included redundant equipment, spare parts, and extensive checkout procedures. Testing on the subsystem however, proved disappointing in the reliability area, probably because too little attention was given to system reliability, in contrast to equipment reliability. Generally ignored in original planning, other material aspects (primarily signal) and human system component error proved unmeasurable by all the pre-test estimators. Results of the series of tests conducted over a two year period indicated that the augmented manual system had more reliability.[15]

Earlier in this chapter, the draft QMR was quoted to state that the Intelligence Subsystem was not intended to alter existing intelligence doctrine or to effect command or staff relationships. Intended or not, a change which actually occurred was a case of extreme centralization of intelligence functions at division level, with a resulting improvement of division headquarters reaction time at the cost of tactical flexability at brigade and battalion level. The current emphasis on smaller unit operations and, more specifically intelligence at battalion and brigade levels, in Viet Nam, reduced the appeal of a division Centralized System to defense planners at this time, at least on an immediate priority basis. Even current tactical doctrine on nuclear war envisions a large number of independent small unit actions.

<u>An Evaluation of the Early Efforts</u>

A great many evaluators deemed CCIS-70 as a failure, but in the author's judgement this is not the case. There is little reason for disappointment because the system did not solve all the problems of the

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15. Ibid, pg. 49.

future battlefield, since no rational man expects any new project to be that successful. CCIS-70 served a pioneer role in systems development at the tactical level. Its success, failures, and the problems it generated served to more clearly outline the specifications and requirements for a successful follow-on system.

CCIS-70 no longer exists, having been superceded by a project known as ADSAF (Automatic Data System Army in the Field). The proposed Division system now is consolidated into Combat Support (Operations, Intelligence and Fire Support) Command & Control and Logistics/Administration. Equipment has been reduced, but new technicological developments have permitted retention of the capabilities of the original three subsystems making up the Combat Support Command Control System (CSCC). The planners and researchers are now operating more on a single step evolutionary development process than the big system approach of the past. Early results of the approach here are more visible at the lower Strategic Level (Unified & Specified Comm .s) where such systems as the Strategic Air Command's 465L and North American Air Defense Command's 425L have overcome similar problems to those facing the Army, thereby becoming major contributors to the United States defense effort (author's note: SAC's 465L automates United States air/missile capability against all potential enemy targets while the NORAD 425L catalogues potential enemy capabilities in the same area in order to program defensive countermeasures). These systems, because of their critical priority nature, got the steady stream of funds, personnel, and solid command backing needed to reach fruition.

Those, and other less successful systems projects throughout the Defense Department, have only served to reinforce those problem areas

outlined by CCIS-70; overall system reliability, human error control, and successful integration of "something new" into a previously alien environment.

While Combat Developments Command and other researchers, both civilian and military, study and design better hardware, more capable systems, and all that goes with them, the user, or in this case Army Intelligence, must grapple with the big picture of information systems within their environment. It is in this context that Chapter V takes up the specific problem areas of system reliability, or operational factors; human reliability, or personnel factors; and psychological factors.

V. CURRENT KEY PROBLEM AREAS IN ARMY INTELLIGENCE

As the previous discussion has outlined, the "computerization of the cloak and dagger trade" has not been a smooth troublefree transition and it is far from fully accomplished. Many of the grand ideas of the planners of the late 1950's and early 1960's have been returned to the drawing board. Others have been modified beyond description. Nevertheless, as outlined in the previous chapter, a great deal of transition has taken place with many beneficial effects.

One could, if he wished, list a plethora of problem areas which have surfaced during the last decade. More realistically, however, this chapter shall deal with those four areas which in the author's opinion hold the key to success of any integration of information system into the military intelligence organization. These are found under the headings of personnel, operations, command acceptance, and judgement integration; the latter two subjects are grouped under heading psychological considerations. The personnel heading deals with human factors and the operational area with system reliability. These areas were outlined as weaknesses in evaluations of CCIS-70. The third problem area was that of integration of something new into a previously alien environment. This covers both command acceptance and judgement integration or the psychological considerations. The psychological considerations require less finite methods of measurement and approach than the personnel and operation headings. All problem areas can and should be worked on concurrently.

Part 1 The Problems Involved in Obtaining, Training, and Retaining Intelligence Personnel

Whenever the Army comes up with a new piece of equipment, its approach has been to organize a school and train currently available personnel in how to use the equipment, using instructors who learned on the prototype. If the equipment is of relatively minor complexity, such as a new mortar, this approach has proved quite adequate. Army training is generally intensive, relatively well presented, and adaptable to suggestion and changes from the field. More complicated equipment; however, has traditionally generated additional problems.

With the advent of sophisticated radar and missile systems during the 1950's, the Army found that its technical proficiency training on this equipment was largely benefitting civilian industry. Since trained technicians were in demand for the growing television and associated electronics fields, at high salaries, and trained military radar personnel were easily adaptable, the military's problem evolved into one of retention.

Attempts at solution were varied including proficiency pay bonuses, upgrading of key positions to Warrant Officer status, and payment of large variable re-enlistment bonuses for long term committments. Nevertheless, the solutions only began to work effectively when civilian demand dropped sufficiently to make the Army's renumeration policies competitive.

A similarity exists in the systems field in that current civilian demand for trained personnel at all levels is very high with no projected reduction in the forseeable future.

The problem is compounded by two special factors. First, the military is behind civilian industry in adapting itself to systems hardware. This is because its needs are so immense and difficult to classify that

justification for funds has been difficult and usually downgraded in priority due to a general lack of understanding. The Army must depend on civilian industry to assist in providing or training personnel which civilian industry, still expanding at a rapid rate in the systems area, wants and needs for itself. Secondly, application of an information system at anything beyond the data processing storage level requires training across the entire grade spectrum to include even top management levels.

Compounding both these factors in Army Intelligence is the fact that this branch is behind other functional areas of the Army in computer application, so that they are in the same poor competitive position in regard to logistics and air defense as the Army is to civilian industry.

Training is required at all levels, so it is a problem as to where to begin. At the Operations level the military needs key punch operators, maintenance personnel, and programmers. At the next level of the hierarchy, Systems Engineers, Systems Analysts, Operations Research Analysts, Executive Programmers, and middle management personnel with a systems orientation are required. Finally, a good level of understanding, at least of the capabilities and limitation of systems application, is required at the upper echelons.

The Viet Nam conflict has provided some assistance, of a temporary nature, at the operations level and to a lesser extent at the middle level. T' [illegible]aft, voluntary enlistments, reserve active duty terms in lieu of the [illegible] d the expanded Reserve Officer Training Corps provide, as a byproduct, many trained personnel in the technical aspects over the short run. In house Army training programs augment the supply at the basic level only. Nevertheless, the current quantity of available personnel is not

sufficient and requirements will substantially increase by the mid-1970's. The ending of the war, followed by the inevitable reduction of selective service quotas and associated recruiting totals will compound the shortage, as trained input decreases and the exodus to more lucrative civilian jobs approximates that of the radar example during the past Korean period.

Solutions in the Personnel Area

Solutions to the problem of obtaining and/or retraining personnel at the lower and middle levels exist primarily in developing a competitive salary structure, to civilian industry, which will meet Army requirements as a whole, thereby covering Military Intelligence at the same time. Officer procurement on a competive entry salary basis would also serve to alleviate the higher level requirements in the long run since the higher caliber entrents would be, in time, assuming the middle and higher level management positions.

Talk of competitive salaries and congressional action are two separate things; however, the current public clamor against the draft, the generally higher educational requirements of national defense as a whole, and the announced intentions of President Nixon all tend to indicate that action in this area can be expected and the Hubbell Plan was presented to Congress by the Department of Defense early this year.[1]

Thus far, little mention has been made regarding the current critical shortage at upper, middle, and top management levels of personnel qualified to deal with information systems. All the systems experts in

1. Details in Army Times, Washington, D. C., December 25, 1968--January 1 and January 8, 1969.

the country can be put in the Army and they'll accomplish very little if they can't communicate with the decision makers.

For the most part, these technicians are not trained in military needs, especially in a specialized field such as intelligence, and therefore they speak a different language than the tactician. The problem is one of two-way communications. The General knows what information he wants, but he has a problem in expressing his requirements to technicians two or three levels below him, especially when the chain of command frequently serves to distort requirements going down and answers coming up. This problem is greatly reflected in the area of command acceptance which is discussed later in the chapter.

Army Intelligence currently recognizes the need for improved communications to the upper management area. Despite the Viet Nam conflict, which is in this case severely restricting officer availability, the Army is making use of its advance educational program funds to send selected field grade officers to such schools as the University of Pennsylvania (Wharton), Harvard University School of Business, George Washington University, and Syracuse University for Masters Degrees in such disciplines as Automatic Data Processing, Systems Engineering, Operations Research, Information Systems, and Production (Industrial) Management.

Although some officers will graduate as highly trained specialists in one specified area, the emphasis is on general management. The author's assignment to the Wharton School of Finance and Commerce is a part of the Army program. It is the author's contention that, if the general management student is capable upon graduation of formulating the commander (or G-2)'s requirements into useable instructions and/or models for systems

technicians, and equally capable of translating their results into meaningful answers for the Commander, then his training meets with the existing need. Training need not make the officer student an expert in operations research, information systems, or anything else. The officer student should seek a functional understanding of each of the major areas while gaining the knowledge and ability to integrate their potential into the overall Command and Control System.

Currently only about 1,000 Army officers attend graduate schooling annually in all fields with about 200 of these in the business area. Military Intelligence is fortunate to have ten in training during any one-year period (a cycle runs 18-24 months to completion). Termination of the Viet Nam war should permit these figures to be increased by a minimum of 300%. This figure can be further increased through command emphasis on voluntary educational advancement with tuition assistance (currently authorized), primarily at such on-post extension programs as one operated by George Washington University at Forts Lee and Eustis in Virginia. Military Intelligence Branch can help in this area in two ways. First, by letting those officers know in a reasonable period of their application for full-time schooling is unlikely to be acted upon and recommending the alternative, and secondly, by stabilizing the officers tour at one location so he can complete the program once he has reached a certain point, such as the half-way mark.

The fact that requirements will still exceed supply, barring the unlikely large increase in funds for tuition purposes, suggests an additional reinforcing alternative. For over fifteen years, selected Army logistics officers have served "a tour with industry", in which they are

detached with full pay and allowances, to work as trainees in selected management areas. The program has proved both a successful training and public relations media.

The author suggests that Military Intelligence consider initiating such a program with such companies as IBM, General Electric, Honeywell, Burroughs, and others with extensive experience to include leasing firms which provide consultative services. This program would be both inexpensive to the government, since it incurs no additional costs beyond regular salary requirements, and to industry, since the officer selectees would be expected to contribute equivalent production to cover industry's training costs. Such a program would prove an additional outlet for the over-staffed officer corps during time of peace and also it could serve as a retraining media should a major reduction if force be required at a later date.

In the personnel area, the problem is defined clearly enough to permit formulation of logical solutions. The Army as a whole, and Military Intelligence in particular, can solve their personnel problems only if they, and the nation see fit to meet the cost.

Part 2 Problems Involved in the Operational Aspects of Intelligence

No information system can function effectively without a thorough analysis and testing of its organization, collection, transmission, processing, and dissemination. CCIS-70 sought to develop a completely integrated information system utilizing subsystems to meet specific functional requirements. Although CCIS was not, at least in the intelligence area, the great success predicted in 1963, the fault lies not in the idea. The difficulty lay in the attempt to build from the top down without the qualified personnel. Industry has built from the bottom up, training as they went along. Although some companies have never left the bottom level, those that have are setting an example of how good information systems can really be. One can appraise the problem areas in operations through a process of elimination.

Army communications are sufficiently advanced to meet those transmission needs the system might encounter. Dissemination, at least in form, is at an advanced state of the art with the development of the Cathode Ray Tube Display to compliment written output. Organization will only change when a system demonstrates a capability to support change; therefore, the operational problem areas which are potentially acute are collection and processing.

Collection

At the tactical level, CCIS-70 called for collection by current methods with integration of collection points at battalion level. Yet, one generally finds a point estimated at 85% provided for that ratio of intelligence available from open sources. Therefore, neglect of newly developing direct access devices entering the data base could be a serious

error if only open source intelligence were considered. At the tactical level, it is already feasible to integrate aerial sensor collection directly into a computer interface even from the air. This makes access even more attractive.

The overriding tradeoff pertaining to collection is cost versus reliability of information. The author's view is, that contrary to civilian industry where a decision making system can tolerate small errors, a military commander can tolerate no additional built-in errors. Those already present, as a result of uncertainty and individual judgement, make a command decision already tenuous without leaving more room for variation. Therefore, if information is required it is doubtful if it can be ignored, regardless of the cost of collection.

Collection capabilities, particularly through sophisticated advances in communications and surveillance areas, have outdistanced the other areas of intelligence. Almost everything required to form a valid estimate can be collected if the collection effort has been properly focused. It actually breaks down to effective use of available information, or in reality the processing problem.

Processing

The basic problem, true in any field of human investigation, is to develop a methodology which will facilitate the making of valid inferences from the available evidence. Perhaps in the intelligence field more than any other, this process is a particularly complex one.

Dr. Maurice H. Hellner notes that the complexity arises from two principal causes: the nature of raw information and the character of processing

requirements.[2]

Raw intelligence data has a wide variation in form, content, timeliness, and reliability. It has excessive complicating detail allowing most indicators to be balanced by a contradicting indicator. The raw data comes in a high volume with both gaps and inconsistencies. Some of the information sources may be non-controllable and the enemy can be expected to employ deliberate deception and disguise of vital elements.

The unique character of processing requirements is caused by the great importance of random and often rare events, an unpredictability of processing load, a tendency toward rapid change in the focus of command (and therefore analyst) attention, the wide variety of user requirements, and severe time restrictions on some processing tasks.

Superimposed upon these factors is the difference in nature between a physical or social scientist and an intelligence analyst. The former search for indicators of classes of events while the latter are concerned with indicators of specific events, without ruling out completely the event class. More specifically, the analyst seeks adaption of a scientific method developed to analyze a family of recurrent events to a method which permits valid predictive inferences pertaining to unique and possibly non-recurrent military events.

Although characterized as unique in character, no event can be dealt with completely apart from everything else. Classification and categorization are fundamental to human understanding. In the intelligence field categorization is a delicate process. The rules for defining categories are influenced markedly by the analyst's (and frequently the commander's) estimate of the situation.

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2. Hellner, Maurice H. Dr.; "Evidence and Influence in Foreign Intelligence", unpublished Defense Intelligence Agency Research Paper, 1968, pg. 5.

The history of intelligence processing reveals that important pieces of information are often placed in the wrong category for no other reason that that the prevailing "estimate" made it logical to do so. For example, the USSR was surprised by the German invasion of 1941, in spite of ample evidence that German troops were massing on the frontier, because the party line emanating from Stalin was that the Germans would not attack.[3] This example cannot be pushed aside as another manisfestation of inflexibility within totalitarian systems, since Winston Churchill points out that the British made the same error in this situation. The British categorized the troop buildup as pressure to increase war materials to Germany, since the British "Estimate" considered that Germany and the USSR had a community interest in dividing the British Empire; therefore, making such an attack illogical.[4]

Through always perfect hindsight, one can retionalize (but not excuse) the British error by citing the frequently illogical behavior of Adolf Hitler, but considering that even that was somewhat evident in 1941, how would an analyst categorize a fact such as this?

An individual indicator is not likely to be conclusive. If it permits any inference to be drawn, such inference can provide only a probability relationship to any given situation. Each indicator, when viewed alone, is susceptible to a number of interpretations. In developing an indicator profile, the problem is determing profile confines since the implication is a non-symmetrical relationship. The reverse of "if 'x' then 'y'" is not necessarily true.

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3. Seth, Ronald: Operation Barbarossa, London, England. Anthony Blond, 1964, Chapters 4 and 7.

4. Churchill, Winston S., The Grand Alliance, Boston, Massachusetts, Houghton, Mifflin Co., 1950, pp 359.

Even the use of such terms as "evidence" and "inference" has a deceptive clarity in the intelligence area. Evidence normally refers to an accumulation of data while inference refers to conclusions not included in data, but "logically" deduced, inferred, or extracted from it. To the intelligence officer inference and fact become integrated in such a manner that it is impossible to separate them neatly. Yesterday's inference is today's basic data. More significantly, both obvious and subtle past inferences shape current "facts".

The main stream of events and indicators may obscure an important event. United States intelligence accurately predicted the time, place, and direction, of the main Japanese attack directed South toward Indonesia, the Philippines, and Malaya in 1941.[5] Nevertheless, the community became so obsessed with the big picture that it ignored the collection and processing necessary for detection of the secondary attack, against Pearl Harbor.

Accurate analysis of raw information is sometimes complicated by the fact that more than one major event may be developing at the same time. In such cases, categorization of indicators becomes confusing because some indicators may point to one event, some to the other, some to both, and some to neither.

A recent example in Viet Nam might be the massing of North Vietnamese troops on the Cambodian border, which points to event A, "attack on Saigon"; event B, "withdrawal to sanctuaries prior to peace talks"; event C, "reorganization after losses and receipt of replacements"; event D, "return to Phase II guerrilla warfare", and several other possibilities.

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5. Wohlstetter, Roberta, "Pearl Harbor, Warning and Decision", Stanford, California, Stanford University Press, 1962, pp. [illegible].

International military affairs are characterized by action and reaction. It is extremely difficult to analyze accurately the likely courses of any enemy's actions except in relation to actions and policies of others, most likely the "friendly course of action". Moreover, the "facts" that friendly estimators look at are probably not identical to those of the enemy's estimators. The United States officer, operating on the staff in Viet Nam, considers that, since the 1968 Tet offensive proved disastrous in casualty losses for the enemy, a reoccurrence seems less likely than some other strategy. The enemy commander; however, considers these high losses as a regrettable, but acceptable, cost to pay for favorable world press reaction to end the war and a substantial timing setback to allied revolutionary development programs. Correspondingly, he plans a second offensive for 1969. Both the United States officer and his enemy counterpart are looking at the same so-called facts, admittedly colored differently. Their interpretations widen the existing differences frequently resulting in two divergent decisions.

Consider the compounding of these errors if one is not fully cognizant of his own nation's strategy. In 1941, United States Forces Pacific intelligence officers in Hawaii were impossibly handicapped by a lack of knowledge of United States diplomatic moves during the complex action-reaction sequence between the United States and Japanese governments.[6] In Viet Nam, this problem has been reduced, but not eliminated entirely. It is without doubt a worthy goal to seek elimination of any friendly information gap since it is one of the few controllable variables in the intelligence information picture. If the actions of a Battalion Commander can effect

6. Ibid, pp. 386

national policy, then that commander and his staff assistants had better be aware of what the national policy is and when it changes.

In Intelligence, analysts are dealing primarily with descriptive data. Information pertaining to casual relationships is lacking, thereby further complicating the problem of drawing valid inferences.

Transient relationships and characteristics are often more important than permanent or invarient ones. Thus, the transient relationship between the South Vietnamese 1st Division and an independent South Vietnamese airborne battalion may be far more meaningful to a North Vietnamese Commander than any formal allied order of battle. The formal structure may list three infantry regiments and one armored cavalry regiment under 1st Division command and note that two Artillery Battalions and one un-numbered airborne battalion from Corps or Army Reserve will also be attached. This information in itself tells the NVA commander very little, but let him learn that the airborne unit on hand is the 7th (noted for its aggressiveness), or the 5th (loaded with replacements after a retraining cycle) and he has a much better picture of the 1st Division's capabilities and probable courses of action in the weeks to come. Accordingly, enemy agents showed great interest in the comings and goings of RVN airborne units as they rotated out of Saigon. It is in this area that the greatest poverty exists; in methodology for structuring data base to accommodate transient characteristics and relationships.

In the real world, a solid prediction often goes bad because of the intervention of an accidental event--the bombing death of Le Thanh, NVA commander in the South, cancels an enemy planned offensive; a plane crash upsets plans for an African coup d'etat, etc. For this reason alone, the least one can hope for in intelligence is prediction in terms of probability.

To the research scientist, time may not be of a particular consequence. He is after a high degree of confidence in his results and is willing to take the time to get them. The intelligence officer, conversely, may have a three-hour crash deadline to prepare his briefing for the commander. The element of error is highly compounded as limited time reduced fact collection, identification, and elimination of gaps, while increasing possibility of human interpretation error. The probability prediction drops in validity.

Finally, there is the age old problem of understanding behavior which is alien to one's own culture. Any attempt to develop simulations, models, or profiles of indicators must face the fact that one person's criteria and belief systems may not be accurate with reference to a foreign society.

Allen Dulles, former Central Intelligence Agency Director, characterized this point as follows:

> "Actions and reactions can no longer be estimated on the basis of what we ourselves might do if we were in Khruschev's shoes, because as we have seen at the United Nations, he takes off his shoes."[7]

Examples of such misunderstanding abound throughout United States relationships in Asia. During his period of service in Viet Nam, the author had the occasion to role-play an enemy commander for purposes of war-gaming possible enemy strategies. Any success experienced was largely because the author had lived as a boy in the Philippines and China and because he had studied enemy doctrine (Mao Tse Tung and Vo Nguyen Giap) for several years and current enemy tactics for over six months before his supervisors would

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7. Dulles, Allen, "The Craft of Intelligence", Harpers, New York, New York, 1963, pg. 169.

let him try the role. The intelligence officer's attempt to play the opposing commander is a sometimes helpful technique, but only if all concerned realize the inherent subjective inaccuracies involved.

In view of the long list of obstacles and difficulties, it might appear that intelligence processing is destined to remain more of an art than a science. By and large, it does not appear feasible to formulate any "laws of events" in the military arena in pure quantitative terms, although such techniques as game theory, model building, simulation, statistical inference, and operations research all appear to have application in restricted areas.

In the real sense, the heart of the problem of intelligence analysis is to draw valid inferences from circumstantial evidence. If approached in this manner, the author believes that progress can be made in developing a methodology. This thesis uses the term circumstantial evidence to mean certain facts which might be said to surround the main event in contrast to evidence which bears directly on the main problem. This technique in effect puts together the pieces of a picture puzzle, but this puzzle has many parts missing, while others are damaged, distorted, or faked.

Solutions in the Processing Area

It is true that in a vast majority of cases in which reasoning is based on circumstantial evidence, one cannot easily generalize the result. This is because the majority of cases dealt with are not likely to reoccur in exactly the same form. Since this is precisely the case in intelligence anyway, this thesis suggests that this approach is the correct one.

If one accepts the foregoing reasoning, then he would best construct a system for which the various items in evidence form coherent parts. The analyst might begin with a suggested solution to the problem based on something in the subject matter or previous evidence. The purpose of a formulated "hypothesis" is merely to direct the search for order among confusing facts. It is not a license for "guesstimate" intelligence which commanders, quite correctly, fear more than the enemy himself.

In the past, intelligence officers have shied away from the hypothesis method, because of the fear that a pre-judgement or committment would close the mind to contrary facts. They believe that any given situation should be studied without prejudice or presupposition.

Scientists learned long ago that nature gives little helpful reply to a general inquiry, since the reply will be as general as the inquiry and frequently subject to multiple interpretation. Many people have learned to their sorrow that the computer reacts in the same way. Interrogation by specific questions is required. In reality, the observer for all his talk of objectivity really observes most of what he has been led by a subconscious hypothesis to look for anyway. By admitting what he is doing, he is more likely to do it correctly.

It is frequently stressed that the intelligence analyst must be openminded. This should not be construed to mean mental vacuity. There is an important difference between hypotheses that invite investigation and fixed theories that control investigation. The former is really a mental attitude, an approach of the categorizations of facts. It is a method of assuming certain situations experimentally in order to test the results; a type of simulation. The hypothesis may prove unsatisfactory and be discarded.

It cannot be denied that the tendency to bestow parental affection on one's offspring, the hypothesis, may eliminate its usefulness. One means of control is the use of multiple hypothesis, thereby creating a family and thus reducing undue affection for one or another of the offspring hypothesis.

The multiple hypothesis method is a logical extension of the single hypothesis approach. In the single hypothesis technique, the analyst selects a solution to a problem suggested by previous experience of the subject matter and treats the hypothesis as a premise for approval or disapproval. In the multiple hypothesis method, the analyst states as premises all logical solutions to the problem in such a way that one must be correct. He then attempts to test all hypotheses concurrently with the objective of selecting the correct hypothesis from the evidence.

A classic allied World War I intelligence failure provides an excellent vehicle for illustration of the multi-hypothesis technique. As President Roosevelt prepared for the Yalta Conference in early 1945, the Joint Chiefs of staff brought pressure on him to persuade Stalin to bring the USSR into the war against Japan.[8] Their concern was the 700,000 man Japanese Kwantung Army in Manchuria which had a reputation of being an extremely efficient, well-commanded, and effective fighting force. Since this area was a secondary one prior to the Philippine invasion, there was no high priority collection effort for information. This resulted in the "facts" available on the Kwantung Army in 1944 being the same ones available as in 1941. Armed with these intelligence provided "facts", the Joint Chiefs

8. United States Congress, Senate, Committee on Armed Services, Hearings on the Military Situation in the Far East, 82nd Congress, 1st Session (1951). On page 3332, two memoranda from the JCS are reproduced verbatim.

formed the valid conclusion that an allied conquest of Manchuria without Soviet help would result in high United States casualities.

President Roosevelt responded to the military recommendation and proceeded to "persuade" the Russians to enter the war against Japan in exchange for territorial acquisition in the Kurile Islands.[9] When the Red Army crossed the Manchurian frontier during the summer of 1945, the Kwantung Army crumbled in their path. Only after the war was over did the United States learn that the Kwantung Army had been depleted and was far from the effective fighting force expected. Most of its elite units had been transferred piecemeal to the battle areas of the Pacific as the need for them arose. In January 1943, the Japanese had fourteen divisions in Manchuria. Two years later, ten divisions plus 50,000 men in smaller units had been shipped out.

This discouraging failure of intelligence becomes unforgiveable when it is realized that the information which would have permitted an accurate estimate of the situation was in the system, consisting of non-collated bits and pieces within the United States Intelligence Community. As United States forces captured island after island in the Pacific war, the Japanese units which were destroyed were noted by historians, but no effort was made to relate these unit identifications to previously held order of battle in Japan and Manchuria. Even in one case where the relationship was reported (Army G-2 on Saipan observed that the Japanese 50th and 135th Divisions were listed in OB as Kwantung Army), no particular significance was attached to the fact, possibly because not EEI had been levied on the subject by any higher or adjacent headquarters.[10]

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9. Toland, John. The Last 100 Days, New York: Random House, 1966 pg. 107.

10. Farago, Ladislas: War of Wits, New York: Funk and Wagnals, 1954, pp. 106-110.

If the Manchurian analyst in Washington had been operating under a single hypothesis technique, he might have levied proper EEI to guide and intelligence officer in the field to information bearing on the correct solution. Then again, he might have been using the hypothesis of the Joint Chiefs of Staff formed in 1941, thereby obscuring the EEI which might refute it. Under the multiple hypothesis technique, the analyst would have formed a minimum of two opposite hypotheses, one positive and one negative, developing EEI to cover information gaps in each one. One of these EEI should have guided at least one G-2 along the "island road". His report would have generated further analyst interest and ultimately led to a more correct assessment of the Kwantung Army. With no need for Russian intervention, President Roosevelt would have not needed to seek it with concessions. The idea of United States forces in Manchuria rather than Russian leads to some very interesting possibilities in post war Chinese history.

A problem with a multiple hypothesis technique is that the human mind has difficulty in pursuing more than one line of reasoning at the same time. Simultaneous vision from different standpoints appears virtually impossible for the unaided human mind.

It is here that the introduction of computer technology into intelligence processing is so important. The computer can provide the assistance needed for employing multiple hypotheses if a higher order of man-machine interface can be achieved.

The requirements of such a multiple hypothesis system are demanding. In his analysis of "Evidnce and Inference in Foreign Intelligence", Dr. Maurice H. Hellner mentions five requirements for an effective analyst's computer paraphrased as follows:

1. An on line-time sharing system that offers more than retrieval of a specified information item on demand. The system needs a query capability permitting hypothesis testing.
2. Data bases which are structured not only to permit categorization of data according to common characteristics, but also to permit discovery of connections whereby one item of data can be related to another.
3. Data bases which are structured to accommodate permanent characteristics and relationships, but also transient characteristics and relationships.
4. Extensive use of "feed back" so that valid inferences can be fed back into the data base.
5. Research into those kinds of events which are reasonably predictable on a probability basis, probably beginning with a ranking of important kinds of events in terms of their probable predictability.[11]

The rapid development of computer technology gives good reason to expect that requirements (1), (2), and (4) can be met by advanced generation hardware now or in the immediate future. The other two are farther in the future, but at the level of the Division commander, they are more readily dealt with. If the total number of hypotheses combinations is only two or three, which is frequently applicable below division level, the analyst does not need automated assistance. Equally important to consider at the current level of technology is that the total number of combinations can also be too high e.g. eight hypotheses taken two at a time (20,160) to

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11. op. cit. Hollner, pg. 15-16

expect the computer to do any more than run an endless sorting program or simulation resulting in meaningless or non-timely results. At the division level the combinations are workable, with a total of ten as the expected maximum (attack, attack-reinforced, defend, defend-reinforced, counterattack, counterattack-reinforced, three combinations or counterattack and defend, and the withdrawal option). These hypotheses are all sufficiently related to permit probability determinations. In addition the rapidly changing tactical situation permits available transient information to be considered on an equivalent basis with more permanent data.

Most important, the computer permits a more complete analysis of all available alternatives within the short time requirement normally levied on the intelligence officer by the commander because of the situation.

Application of the Multi-Hypothesis Technique

Since the role of postulated hypotheses is to relate and explain data that have been assembled and are pertinent to the problem at hand, as well as to identify knowledge gaps, the analyst must be especially careful to form meaningful hypotheses. In this regard the hypotheses must be mutually exclusive (only one can be correct) and exhaustive (at least one must be correct). In other words, one of the selections should be right and the others wrong. This technique can develop a fantastic number of combinatorial probabilities at the strategic level where breaking down a "not correct" hypotheses might require 20 to 25 sub-hypotheses explaining the phenomena. However, at the tactical level, the hypotheses are limited to enemy tactical reactions of attack, defend, withdraw, and a combination of reinforcement with the attack or defend option. A specific counter attack option might be considered. The total number of hypotheses is a workable one in any case.

The use of a multiple-hypothesis approach suggests the utility of a formal methodology in intelligence production. Researchers have been working for some time on model development in this area. One Defense Department research group believes that the Bayesian Decision Model has possibilities.[12]

It is the author's contention that one of the military's greatest errors to date has been its tendency to search for a catch-all model solution which permits the user to fill in the data and will melt all his problems away. This thesis seeks to develop a methodology to aid in general problem solving rather than for the solving of a specific problem.

There are specific advantages in using a formal methodology in intelligence production efforts. These advantages include the following:

1. Formalized techniques couple evaluated input data and resulting products in an explicit manner. Since each integrated item produces a corresponding change on the intelligence output, there is a reflection of both utility and fidelity of each input item. The analyst is provided with a diagnostic capability to examine and re-examine the rationale underlying his hypothesis. He also has an indication of the plausibility of each alternative under consideration at any point in time. If time pressures, as they so frequently do, prematurely terminate his efforts, he can report the relative weight of each possible alternative.

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12. Blunt, C. P., Luckie, P. T. Marec, E. A., and Smith, D. E., "The Role of Plausible Reasoning Within Military Intelligence: An Application of Bayes Theorem as a Model for Problem Solving". HRB Singer, State College, Pa., 1967.

2. The techniques provide a means for integrating the effect of both conflicting data as well as substantiating information. The importance of conflicts can be compared to the significance of their impact on the intelligence output; therefore, the techniques may be useful in minimizing the efforts necessary to resolve critical differences, in the data base.
3. Such techniques probably can synthesize the analysts' individual judgments better than man can.
4. These techniques, when combined with on-line computer processing technology, offer the analyst a rapid, efficient method of organizing his data base, evaluating new inputs, and updating his products.

Once hypotheses have been established that exhaust the possible solutions of a problem, the processes of problem solving can continue by testing these hypotheses. One strategy in this approach is to earnestly attempt to discredit all of the hypotheses. Those hypotheses surviving such a test become stronger candidates as possible solutions to the problem. Another strategy, more in line with the author's thinking, is to examine all supporting data to determine which of the possibilities are most credible. Both strategies are useful methods in problem solving and incorporate the processes of logical deduction and plausible induction.

Deduction is a logical reasoning which includes the deriviation of conclusion by inference. The deductive process starts with premises and proves by inference to a conclusion. The premises may be facts, convictions, hypotheses, or assumptions. J. M. Anderson describes deduction as a transmission process.

"...the propositional rules transmit truth from premises to conclusions in any sound inference. If there is a deduction - i.e., a sound inference - then it is impossible for all its premises to be true when its conclusions are false."[13]

One form of deductive arguments can be represented in the following structures:

If A, then B

A	premises
B	conclusion

If A, then B

not B	premises
not A	conclusion

The symbols "A" and "B" represent sentences like "the army is attacking" and "its supply lines are difficult to maintain", etc. Thus, if it is a known fact that all attacking armies have difficulty maintaining their supply lines, then the observation of an army in an attack permits the conclusion that the army is having difficulty maintaining its supply lines. Conversely the knowledge that the army is not having difficulty maintaining its supply lines permits the conclusion that the army is not attacking.

The reliability of conclusions reached by deduction depends upon the truth of the premises and the validly of the inference.

False conclusions can be drawn from true premises by fallacious reasoning, e.g.,

if an enemy battalion is North Vietnamese, then it has a political officer
Battalion 60/1 has a political officer
Conclusion: Battalion 60/1 is North Vietnamese

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13. Anderson, J. M., "Natural Deduction, the Logical Basis of Axiom Systems", Wadsworth Publishing, Belmont, Calif., 1962, p. 79.

In this situation both North Vietnamese and Viet Cong battalions have political officers; thus while all NVA battalions have political officers, not all battalions with political officers are NVA.

False conclusions can also be derived by valid argument if the premises are not true, e.g.,

if the NVA plan an attack across the DMZ, then Nam Long will command
Nam Long is not in command
Conclusion: the NVA do not plan an attack

In this situation it may be a fact that Nam Long is not in command; however, if the premise

"if the NVA plan an attack across the DMZ, then Nam Long will command"

is an unverified hypothesis, it may be possible that someone else will command; hence, it could be possible that the attack is planned under another commander.

One method of rejecting an hypothesis (H) is to pose it as the antecedant of a conditional statement and demonstrate that the consequent (C) is false, i.e.,

If H, then C
not C
Conclusion: not H

Thus an hypothesis might be formed as follows:

H=North Vietnam is constructing an airfield

Through the construction of a non-trival "true" premise based on this hypothesis, the hypothesis can be tested. For example, assume the following premise to be true:

If H (NVN is constructing an airfield), then C (heavy construction equipment will be used.)

If the surveillance effort shows that heavy construction equipment will definitely not be used, then the analyst can reject H.

Unfortunately, the data available to intelligence is frequently not sufficiently reliable to determine if the premises are true. In the above illustration, it may be certain that all airfield construction uses heavy equipment (in fact, NVN frequently uses none). Also our surveillance may have failed to observe the equipment which was in fact being used, nor need it indicate that future use is ruled out. In general, there are at least three simple structures that denote the varying point of uncertainity in the premises typical in intelligence.

1. Possibly if A, then B

$$\frac{A}{\text{Conclusion: ?}}$$

which explains and exemplifies uncertain pattern or relationships.

2. It is true that A implies B

$$\frac{\text{possibly } A}{\text{Conclusion: ?}}$$

which exemplifies uncertain input data

3. Possibly if A, then B

$$\frac{\text{possibly } A}{\text{Conclusion: ?}}$$

which exemplifies both problems combined.

Intuitively, "B" exists as a plausible conclusion in each situation; however, the level of confidence in the truth of "B" certainly varies among the different cases. These situations represent examples of plausible deductive inferences. If it is possible to quantify the degree of one's belief in the premises, then it may be possible to derive a level of confidence for the conclusions derived by deductive reasoning. Dr. Ward Edwards,

and a group at the University of Michigan, Dr. D. A. Schum and a group at Ohio State University, and Dr. J. R. Newman with the System Development Corporation, Santa Monica Corporation are currently researching in this area.

Dr. Edwards is primarily concerned with vague verbal data and vague verbal hypothesis for which no hope of frequentistic information linking data with hypotheses exists.[14]

Dr. Schum is looking at repeatable situations in which the set of possible observations is quite limited so that subjects can reasonably expect to accumulate relevant frequencies linking data with hypotheses.[15]

Dr. Newman's research is related to those investigations of human problem solving in which the emphasis has been on the process rather than on output.[16]

The current research into problem solving methodologies has been predicted upon two assumptions. The first is that man can filter input uncertainty quite well and that he can translate this uncertainty into appropriate indices. The second is that machines cannot filter output uncertainty very well but are excellent at combining numerical indices into some formal output.[17]

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14. Edwards, Ward, "Nonconservative Probablistic Information Processing Systems", U. of Michigan, Ann Arbor, Michigan, December 1966.

15. Schum, D. A., "Inference on the Basis of Condionally Non-independent Data", Journal of Experimental Psycology, 72, (#), 1966.

16. Newman, J. R., "Extension of Human Capability through Information Processing and Display Systems," SDC, Sta. Monica, Calif., Dec. 1966.

17. op. cit. Blunt et. al. pg. 33.

The marriage of man and machine should produce a powerful problem solving system. One question remaining unanswered is whether an intelligence report should be a best estimate of a solution presented as a conclusion (or subsequent recommended decision) or the actual list of potential solutions and their assorted weights. The author leans toward the latter approach, although the commander, as is discussed in the subsequent section on psychological operations, might arbitrarily decide what he prefers.

A conclusion is a statement which is to be accepted as applicable to the condition of an observation unless and until unusually strong evidence to the contrary arises. Conclusions are established with careful regard to evidence. Thus, conclusions should be withheld until adequate evidence has accumulated.

The definition of a conclusion has three crucial parts; two explicit and the third implicit. First it emphasizes "acceptance" in the original strong meaning of the word. The conclusion is accepted and taken into the body of knowledge, not just into the context of advice for immediate action. Secondly, the definition speaks of "unusually strong evidence". This implies that only a small percentage of all conclusions will be upset, although it does imply the possibility of later rejection. A conclusion is something of lasting value extracted from the data. The emphasis is on the word "lasting" and not necessarily "everlasting".[18]

Conclusions should be reached cautiously, firmly, not too soon or too late. They will be judged by their long-run effects, by their "truth", not be specific consequences of specific actions.

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18. Tukey, J. W., "Conclusions v. Decisions", Technometrics 2 (4) November 1960, p. 1.

Decisions, on the other hand, are more nearly of the form "let us decide to act for the present as if" rather than "we accept". The distinction is important and too often neglected. The restrictions "act ...as if" and "for the present" convey two separate ideas which serve to distinguish conclusions from decisions.[19]

When it is stated to "act as if <u>A</u> is greater than <u>B</u>", no judgments as to the truth or certainty beyond a reasonable doubt are made on the statement "<u>A</u>" is greater than "<u>B</u>". When it is stated "for the present", the decision maker is referring to the particular situation under consideration "at present".

Decisions to "act from the present as if" are attempts to do as well as possible in specific situations, to choose wisely among the available gambles. The intelligence officer or analyst may be tempted to report a solution as a true conclusion if the probability of that solution is greater than all other solutions. Such an approach must be avoided at all costs as the following example will demonstrate.

Assume that a strike mission is being planned against a North Vietnamese target designated VL-5, and that intelligence has been requested to identify the defensive weapons system defending VL-5. Further assume that all available output at this point on previously monitored photography, etc., is AAA (conventional anti-aircraft) - 0.76 and SAM (surface to air missile) - 0.24. Intelligence would be tempted to respond with conclusion: "Evidence to date indicates that VL-5 is probably defended by AAA." This statement cheats the commander of intelligence he needs to make the decision. More information is available for the commander if associated probability estimates could be combined with command's assessment of the tactical situation.

19. Ibid, p. 2.

Suppose the following situation exists at Air Operations:

1. It is possible to select a high altitude aircraft very effective against AAA but vulnerable to SAMs or a low level aircraft effective against SAMs can be selected with increased vulnerability to AAA.
2. If the high flying aircraft is selected and the VL-5 is defended by AAA the estimated probability of mission success is .80.
3. If the low altitude aircraft is selected and VL-5 is defended by SAMs the estimated probability of mission success is .90.
4. If the high altitude aircraft is employed and VL-5 is defended by SAMs probability of success is only .10.
5. If the low flying aircraft is employed and VL-5 is defended by AAA, probability of success is .60.

This information can be assembled in matrix form as the decision maker utility table:

Actual Situation	High Counter AAA	Low Counter SAM
AAA	.8	.6
SAM	.1	.9

Intelligence can now incorporate our probability figures of AAA (.76) and SAM (.24) to provide the commander with "a success probability" for the two options.

If the decision is made to counter AAA with a high flying aircraft, the probability of success is:

(.8) (.76) ≠ (.1) (.24) or .632

If the decision is made to counter SAM with a low flying aircraft, the probability of success is:

(.6) (.76) ≠ (.9) (.24) or .672

To maximize the chances of a successful mission, the commander would select the low flying aircraft to counter SAM and not the opposite aircraft as pure probability would have insisted.

This result indicates that in order to make a decision, not only the probability of occurrence of each solution is needed, but also the expected value for each of the possible actions which may be taken. The intelligence analyst and even his computer will not be likely to have available all the required utility tables, but under the limited number of tactical options, he should be able to supply a valid estimate of probabilities of each solution.

The multiple hypothesis method combined with the weighted probability technique can be applied to the Intelligence Estimate discussed in Chapter II. Assuming that the Division G-2 now has the desired computer capability with sophisticated man-machine interface, his analysts begin to prepare the Intelligence Estimate for the commander.

The data base is first directed to print out available data on weather, terrain, and the enemy situation. Any obvious gaps are noted at this time and collection requests, if applicable, are sent to collection agencies such as air reconnaissance and photo, long range patrols, higher headquarters, etc. The analyst next poses a series of general hypotheses on possible enemy courses of action such as:

1. the enemy will attack
2. the enemy will defend in current positions
3. the enemy will withdraw to prepared positions.

Other options exist but assume that the situation makes them so highly improbable as to rule them out. The analyst now queries the

computer for information supporting or refuting his hypotheses, one at a time. His experience and the computer's negative replies identify additional gaps for collection. Additional data is either punched in on arrival or more ideally comes in on line from the source such as the airborne platform.

At any point in time the computer can be queried, on the basis of current available information, as to the probability of any of the hypotheses and conceivably of the degree of confidence in the prediction. The commander's own possible courses of action are now matched in matrix form similar to the AAA/SAM example. The estimate is now prepared using computer output for weather, terrain, enemy situation, matrix correlation of enemy courses of action on the commander's possible choices, enemy reinforcement capabilities, probabilities of employment of nuclear or chemical/biological weapons, reinforcements and vulnerabilities. The Estimate can provide a quantified series of options to the commander together with some measure of the degree of confidence reliability in the quantified presentation. The commander can reject the selection in favor of a more innovative approach. Perhaps in some future generation, the computer could quantify that technique; however, there is no way at present to do so unless friendly intelligence had a complete profile of the enemy commander including an extensive data bank on his previous decisions. Of course, at this point assuming the enemy commander and staff have a similar computer, the whole "war" could conceivably develop into a "my computer is better than yours". In reality such a situation is highly improbable since the role of the computer is that of a tool to process and produce the same intelligence that the G-2 works with now, only at a faster pace and in a more complete workable format.

To advance from theory to practice, both command acceptance of the computer and an understanding of the role of individual judgment in the new procedure are necessary for the success of multiple hypothesis processing. No new technique is ever accepted easily, especially in such a tradition bound group as the military. Even if it were accepted quickly, problems would develop in transition, primarily in the integration of individual judgment into an automated system. These areas are discussed in the next section.

Part III. Psychological Considerations

Personnel and, to a certain extent, processing provide subjects which can be defined; however, the most serious short run problem facing Army intelligence today is in regard to systems integration found in the area that this thesis chooses to call command acceptance. Closely akin to command acceptance is a second area called judgement integration, that of determining where the human factor enters a systems estimate. The character of these problems being associated with the human mind permits them to be grouped under the heading psychological considerations.

In general terms, one can visualize these psychological considerations as similar to those accompanying any new innovation or approach. Command Acceptance deals with how to convince the "conservative older element" that the innovation or product is 1) any good at all, 2) is worth the cost, 3) and can help the business or situation. Judgement Integration concerns the role between man and the new innovation or machine, i.e., What is the definition of the roles played by both?

Command Acceptance

The extent of the command acceptance problem can best be illustrated by actual example which occurred in Viet Nam during June, 1967. On that date the widely heralded computer output of enemy order of battle was to be distributed by J-2 MACV's ADP branch of the Combined Intelligence Center. As could be expected, the intelligence analysts were skeptical as to the quality of a report which might replace what they normally worked on. Their skepticism turned to derision when the print-out listed locations and dates over six months behind current data. A substantial number of officers at upper and middle management levels proceeded to close their minds to the computer, "Show me" became "I told you so."

The tragedy was not caused by poor performance by ADP branch. They provided the best available output from input provided to them. The tragedy was caused by the use of a valuable aid prematurely, before building in a valid data base. When the author left Viet Nam in November, 1967, ADP branch was providing a much better output, not optimal but of immense value in background studies and to lower level commanders. Unfortunately many at Saigon headquarters, aware of the events in June, ignored the output. They had no confidence in it.

If the reader multiplies the above example by a figure of 100, he has a rough estimate of the number of times similar events have occurred since systems integration began at the tactical level. This in part has caused a serious short run problem. Systems technology, personnel, and operational effectiveness are improving daily, but despite this, a significant number of intelligence officers, probably a majority, and even more tactical commanders have not any faith in a system that they don't understand well, and that they or a friend of theirs may have been "burned" by in the past.

Such a situation can compound itself because where the commander doesn't want the system, it becomes an expensive toy and the first to suffer from personnel and budget cuts at the local level. Sufficient failures at local level then can force reductions up the line since neither elected officials nor political appointees can tolerate a white elephant subject to scrutiny by the political opposition.

Solutions in the Command Acceptance Area

The problem can only be solved via a concerted effort throughout the intelligence structure to develop confidence in systems capabilities.

Training, as has already been discussed, provides part of the answer. A second valuable tool might be called partial systems integration. More specifically, if the system, as is usually the case, is a long term installation problem then instruct the designers to implement it in workable pieces so as to provide some, however meager, results. Perhaps initially, the equipment can be installed to aid only in filing data. Later the weather might be added. If it takes two years to develop the data base for an area such as enemy order of battle, then consideration to preparing a smaller area data base with subsequent expansion to other areas should be included in designer installation plans. Announcement of computer support in any field, whether the initial program or a subsequent add-on, should not be premature. The system is better late, but right, than on time, but wrong. Once the field becomes aware that some help is available and that the output is valuable, then the designer can forecast those areas scheduled for expanded service. The forecast should be conservative so that generating enthusiasm will be reinforced as the designer meets or exceeds his forecasted schedule.

More important, success at the local level must be publicized within the command and the intelligence family, as a whole. The local commanders are already well aware of the successes claimed by Department of Defense or the Department of the Army. They want a visible demonstration at their level. Major General Joseph A. McChristian, J-2 Military Assistance Command Viet Nam from 1965-1967, used a technique on this order when he lost few opportunities to publicize the current and projected capabilities of his computer equipment. In this regard he pointed out to commercial news media that he could provide immediate computer service to the field on enemy or area order of battle and other related areas.[20]

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20. Newsweek, 5 December 1966, p. 54.

A treatment of command acceptance would be remiss if it neglected to mention the opposite end of the acceptance spectrum, that of blind faith. In a basically conservative group such as the military there are fewer, but nevertheless, a large enough minority to mention. "It can't be raining", states the Brigade S-2 in the Mekong Delta, "the computer estimated at 80% the probability that the rainy season is two weeks away." The computer is merely another intelligence tool, however quickly it responds to inquiry. It can only predict events based on its data input. If the Farmers' Almanac was wrong and it provided the computerized weather data base, then the computer will be wrong. Even if the input is very good, the transient factors, or acts of God, referred to earlier can turn a seemingly solid analysis sour.

Judgement Integration

The question, therefore, is, if not blind faith, where does the analyst or G-2's brain step in to accept, overrule, or adjust the systems output? This problem can be characterized as judgement integration. Where does personal judgement enter into a systems generated estimate? The answer perhaps may seem too simple. The same place it goes under the estimate generated by other means.

The commander places his personal touch on the Commander's Estimate. He does the same thing on the operations Plans and Orders. Similarly the G-2 or G-3 place their own personal stamp on their estimates and preliminary plans for the commander. There is no basic difference in application of the personal touch to a systems estimate than one prepared by a large staff of individuals.

The relationship between a Commander and his G-2 will dictate, as today, what the G-2 can do. If General "X" wants "just the facts, only the facts", then G-2 had nothing to add befo e and he has nothing to add now. His function is to collect and present the facts in the format desired by the commander. In effect he is presenting a basic report. In those more frequent cases, where General "X" wants G-2's opinions and ideas on a particular situation, G-2 can and should present them as he does now in a secondary report form with conclusions pointing out the level of facts supporting them and the source of those facts.

At the lower operating level of intelligence, the analyst's judgement has already been fully integrated into the product if the multiple hypothesis testing system is in effect. The analyst formulated the hypotheses in the first place and although he has used the computer to provide supporting or opposite facts in regard to each hypothesis, his judgement has been entered in to some degree, regardless of how hard he tries for objectivity.

Basically, the psychological problems inherent to systems integration will always be present to some degree. They can be minimized by the same techniques utilized in dealing with them in other fields; careful personnel selection, effective training, and exercising is acknowledgment of their presence and adoption of a plan for meeting them. Ideally, results, clearly demonstrated, provide the answer to command acceptance. Common sense perhaps best characterizes the solution to judgement integration.

VI. A Staff Study Examination of the Role of Systems in Military Intelligence

It is probable that a great many readers of this thesis will be either members of the military or closely associated with it. They may find the thesis format radically different from the military style of writing. Therefore, this chapter, reserved for a summary and conclusions, is presented in a military format known as the staff study, on the premise that the format will help those familiar with it while causing no undue difficulty for others.

An explanation of the staff study is provided for those who require it, followed by the staff study itself.

Early in their careers, the military officer and civilian working around the military are exposed to the Staff Study. This is a formal method of preparing a report for higher authority which has been in use throughout the author's seventeen years association with the military service. The format devised for the Staff Study is a six paragraph one numbered as follows:

1. Problem
2. Assumptions
3. Facts Bearing on the Problems
4. Discussion
5. Conclusions
6. Actions Recommended[1]

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1. op. cit. FM 101-5, pp. 484.

The Problem

To examine the impact of current and future information systems technology on the military intelligence structure at the tactical level with the objective of isolating present and potential bottlenecks to progress which might be resolved within the military intelligence structure.

Assumptions

1. Progress in systems hardware technology, data collection devices, data transmission, and other communications media will continue to increase at an exponential rate.
2. There will continue to be a need for tactical armed forces of a quality to meet reduced reaction times on the battlefield.

Facts Bearing on the Problem

1. Improved technology combined with a need for more rapid reaction capability made many traditional manual intelligence methods obsolete and others are approaching obsolescence.
2. Information systems technology concurrently progressed to a point where it offered a solution to the rapid reaction time requirements.
3. Civilian industry, at first, and other military organizations later attempted to integrate the ADP capabilities into their overall information system with varying success while Army Intelligence remained largely out of the picture.
4. The initial attempt at automating some military intelligence functions at the tactical level occurred during CCIS-70, a researched command and control information system of which the Intelligence Subsystem was an integral part.

5. Although CCIS-70 was not the unqualified success desired and in fact more of a failure than expected, it provided valuable experience in guiding the outline of specifications for a follow-on system currently under development.

6. Analysis of CCIS-70 and other systems disclosed the major problem areas as overall system reliability, human error control, and successful integration of new concepts into a tradition bound environment.

Discussion

Army intelligence problems outlined above are more clearly defined if broken out into the functional areas of personnel, operations, and psychological factors. In searching for a vulnerable point of attack, the operational area, and more specifically, the processing sub-area under operations, stands out as the key to progress. This is because considerable progress in both the personnel and psychological areas can be achieved as a byproduct of improved processing. The need for trained personnel is most critical in the middle management area. It is in this area that the commander's problems are translated into programmable computer queries and where computer solutions are analyzed and adapted to the commander's requirements. Improved processing permits a reduction in the conflict between the military and machine environments, thereby reducing somewhat the quantitative need for personnel. Within the psychological area are two sub-areas, command acceptance and judgement integration. Progress in the former, command acceptance, depends primarily on demonstrated proficiency of results, results which will be of higher quality and more quickly delivered when the processing problem is under control. The judgement

integration problem literally melts away if the analyst and his superiors understand the capabilities and limitations of the processing function.

Operations, as the general area including processing, also covers collection, transmission, and dissemination, all sub-areas in which progress exceeds processing improvements. Therefore, the current progress lag of processing in effect slows the effort across the entire spectrum of automated intelligence progress.

If processin is accepted as the area for emphasis, then a narrowing of problem definition is possible. The basic processing problem can be defined as one of drawing valid inferences from circumstantial evidence, or in effect correctly putting together a picture puzzle with damaged, missing, or distorted parts. The difficulty presented by this problem puzzle is the direction of the search for order among confusing data.

Scientists have found that the testing of a formulated hypothesis is most helpful in regard to directing a search among confusing pieces of data. This technique has not been generally accepted in the intelligence area because of the dangers of pre-judgement or committments.

The danger of pre-judgement or committment could be reduced if a multiple hypothesis technique were employed. Such a technique would involve formulating two or more hypotheses, covering the logical range of possible outcomes in the same area. This would permit organization queries within the system, and formation of essential elements of information to fill intellignece gaps in any of the hypotheses.

Such a technique can become increasingly complex and time-consuming for the human mind and it probably would have been discarded in the past.

The computer, however, offers great-possibilities for assistance and extension of the human mind.

In order to provide the advanced man-machine interface necessary to achieve our goal in multiple-hypothesis processing, four capabilities are necessary for the desireable computer. It needs an on-line time sharing system with query capability, a structured data base permitting data categorization by common characteristics and discovery of related connections in seemingly unrelated data, a data base which can accomodate transient relationships, and an extensive feedback capability to feed valid inferences back into the system. Additionally, continuing research is necessary regarding the event - event probability relationship to permit more quantifiable results.

Current equipment is capable of providing an on-line time sharing query capable system with extensive feedback and a structural data base. Use of the multiple-hypothesis technique serves to provide the categorization capability through its inherent characteristics. Both the transient relationship and probability level present imposing obstacles at the national intelligence level, but may be considered controllable at the tactical level where most information is transient (reducing the problem of evidence weighting) and where the total number of possible events, and formulated hypotheses, can be adapted to the traditional military attack, defend, reinforce, withdraw framework.

Although improved processing is indicated as the primary vehicle on the road to system success, the personnel and psychological areas cannot be ignored.

In the psychological area, training is the key to unlocking the door. Proper preparation through multi-dimensional training can achieve results in both the command acceptance and judgement integration areas. Multi-dimensional training refers to that of the user at the top, the operator at the bottom, and everyone in between. The users, commander and staff, need a level of training dealing primarily with system capabilities, system limitations, and problem definition techniques. Operator training, as currently available, requires tailoring to military applications, to include integration of hypothesis formulation into the picture at the analyst level. Sufficient training of the personnel "in-between" is required to permit their effective supervision of operators, their application of system generated information to specific intelligence requirements, and their presentation of usable information to the commander together with advice and recommendations where appropriate.

The personnel area can be viewed along the same line as multi-dimensional training. The entry, or operator, level requirements depend greatly on a reform in the military compensation system, a problem largely out of military hands. Short range user training for all officers and medium range training for those officers not likely to receive specialized courses during their career (primarily combat arms officers) can be conducted within current training schedules. In the middle range, however, a need exists for a greater number of specialists than are currently available through the limited advanced civilian schooling program. Although possible solutions include increased civilian school quotas, presentation of long term (over six months) courses in house, or utilization of training with industry in a manner similar to the logistics specialist program, the latter industry,

solution is probably less costly and most flexible. In any case, the Viet Nam conflict precludes much of an increase of personnel in training by any method. Following a cessation or substantial reduction of hostilities, many middle grade officers will become excess to daily army requirements and, therefore, be available for increased time in the training pipeline.

Conclusions

1. Improved performance of intelligence information systems depends most on improving the processing system capability within the systems.
2. Improved processing will also assist in reducing the other problem areas in the personnel and psychological fields.
3. Processing can best be accomplished through the use of a multiple hypothesis technique of formulating a series of hypotheses and structuring data to support or refute each one.
4. The above technique, if requiring more than two or three formulated hypotheses, will probably require computer assistance for the analyst. At a minimum such assistance would be needed to sort and store facts in appropriate plus and minus categories under each selected hypothesis.
5. Required computer capability is available to meet the need for assistance at the tactical (primarily division) level, since the total number of hypotheses and restricted input are within controllable limits for rapid categorization. Further technical progress will be required to provide similar aid at the strategic level where both possible hypotheses and input far exceed currently controllable limits.

6. Psychological problems can best be alleviated through both system demonstrated results and multi-dimensional training.

7. ADP training requirements for all missions of Military Intelligence Branch are most critical at the middle management level, a problem area which cannot be solved entirely within the military structure.

8. A comprehensive period (probably of one year duration) with selected industry can provide valuable systems training to middle management personnel at lowest cost to the government, industry itself, and the individual taxpayer.

9. These trained personnel would, in the long run, alleviate the higher level user training requirement except for some pure line officer positions.

Recommended Actions

1. That the technique of multiple-hypothesis testing be taught as a standard technique at the United States Army Intelligence School, Fort Holabird, Maryland, and other selected intelligence schools.

2. That the ADSAF Project Manager be directed to place priority emphasis on providing a third generation on-line computer system to the Division level G-2 or that a separate project be authorized for this purpose.

3. That a familiarization course on the capabilities and limitations of automated intelligence be prepared by the United States Army Intelligence School for CONARC (Continental Army Command) inclusion into all officer education courses from career course level upward.

4. That a detailed study be prepared for the Defense Department outlining the critical entry level shortage of systems personnel together with possible remedies.

5. That the Army Intelligence School or some other appropriate agency begin consideration of and preliminary negotiations for placing middle grade officer personnel on duty with systems oriented industries for a period of approximately one year. A pilot project might be implemented immediately with the objective of rapid expansion upon termination or substantial de-escalation of Viet Nam hostilities.

Appendix 1 Intelligence Estimate, Corps

(Classification)

G2 Section, 1st Corps
OLIVIO(0256), KURTANIA
101200 August, 1960

INTELLIGENCE ESTIMATE NO. 88

Reference: Maps, KURTANIA, 1:250,000, BONNOTI-LESLETA Sheets T-3 * * *

1. MISSION

a. Defend the area, SEIRATA (4801) -- * * * all points inclusive. prepare to continue the attack towards * * * on army order.

2. THE AREA OF OPERATIONS

a. Weather,

(1) Existing situation. During the period 10 to 20 Aug. weather will be fair except for scattered occasional showers. Visibility will be unlimited except when reduced to one to three miles during showers. Surface winds from the west at 5 to 12 miles an hour. Winds aloft for yields of tactical interest are usually about 15 knots from the west. Atmospheric pressure will average about 980 millibars. Temperature will range from about 57° to 90°F. New moon: 10 Aug.

Light Data

	BMNT	BMCT	EECT	EENT	MOONRISE	MOONSET
10 Aug	0402	0443	2007	2051	New Moon	2223
*	*	*	*	*	*	*
20 Aug	0420	0458	1948	2028	1815	0210

(2) Effect on enemy courses of action. Weather, except during showers, gives Aggressor excellent observation in the defense or attack. An attack during the period will have good cross-country trafficability. Cross-country trafficability, and observation will be only slightly restricted by moderate showers. Winds do not favor Aggressor use of smoke, toxic chemicals, or fallout. Weather favors Aggressor use of nuclear weapons and his air and airmobile operations.

(3) Effect on our course of action. The weather favors the defense. Fair weather favors exploitation of our armor, artillery, and air power, and use of nuclear weapons. Surface and winds aloft favor our use of smoke, toxic chemicals, and fallout.

b. Terrain.

(1) Existing situation.

(a) Observation and fire. There are few good observation points, except along * * *. Smoke from forest fires caused by nuclear weapons is likely to * * *. Fields of fire throughout the area for flat trajectory weapons range from excellent to poor, being limited by * * *.

(b) Concealment and cover. Good concealment is afforded by the wooded areas. Some concealment and cover are available in * * *. The numerous deep ravines and folds in the

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ground offer some protection from thermal effects of nuclear weapons, * * *.

(c) Obstacles. SHAMUS River fordable; fordable with difficulty north * * *. The soil, even where under cultivation, is firm and capable of supporting extensive heavy-wheeled and tracked vehicle traffic. In stream bottoms the wet soil will magnify the cratering effects of subsurface nuclear bursts and will only support light-tracked and wheeled traffic. Soil composition favors the productions of high intensities of induced radiation. Terrain favors Aggressor use of persistent toxic chemicals in the valley forward of his position in the southern part of the corps sector. Woods in the vicinity of * * * will become major obstacles in the event of blowdown or if set on fire.

(d) Key terrain features.

1. Hill mass 377 (3704) and ridge to the north. This terrain feature has the highest elevation in the corps sector. If seized by Aggressor he can control by observation and fire the entire forward portion of the western half of the corps area. It also controls, in depth, all avenues of approach leading into the * * * area.

(e) Avenues of approach.

1. Avenue of approach into our position:

(a) Axis WALSO (5606)-- * * *--ALETHEA (2898). The road net in this avenue of approach is excellent with major roads leading into our position. There is adequate room for deployment of one motorized rifly division * * *.

* * * * * * *

2. Avenues of approach into Aggressor's position:

(a) Axis LAURIEA (5682) * * *. This approach reaches dominating terrain early by crossing the * * * saddles, thus avoiding the deepest and steepest portions of two major cross compartments. The artifical obstacles in these saddles are shallow. Once the area of Hil * * * is reached this avenue of approach follows a wide ridge large enough to accommodate a division. The road net in this avenue of approach is fair and there are no trafficability problems.

* * * * * *

(2) Effect on enemy courses of action. Terrain does not favor Aggressor attack. Woods and valley obstacles will slow and canalize Aggressor movements. The best defensive areas are * * *. The best avenues of approach to these areas are * * *. The most favorable approach for an Aggressor attack is * * *.

Terrain favors Aggressor delivery of nuclear weapons by low-level air attack as long as he controls UMPSCHLEIDO ridge.

(3) Effect on our courses of action. The terrain favors the defense in the area * * *. The best avenue of approach to this defense area is * * *. The steep slopes of the * * * are formidable obstacles to mechanized attack. The broken rolling country and steep stream valleys within our position favor defense on successive positions. Near the corps south boundary the terrain is relatively open with no terrain obstacles between * * *. The terrain generally favors the use of nuclear weapons. Rubble and blowdown resulting from nuclear blast could make formidable obstacles of cities, towns, and woods in the zone. The terrain favors the use of toxic chemicals.

c. Other Characteristics.

(1) Psychological. Aggressor nuclear attacks of nonmilitary targets have resulted in bitter hostility by local civilians to Aggressor forces.

(2) Effect on enemy courses of action. Attitude of civilians will probably hamper operations of Aggressor guerrillas in our sector.

(3) Effect on own courses of action. Hostile attitude of civilians toward Aggressor can be exploited to assist in antiguerrilla operations.

3. ENEMY SITUATION

a. Dispositions. Annex A, Situation Overlay.

b. Composition. Aggressor forces opposing the corps are estimated to be the 40th and 195th Rifle Div. and elements of the 40th Rifle Regt, 19th Rifle Div. Aggressor 22d Corps, which is known to be operating in this area, is believed to be the controlling headquarters for the 83d, 40th and 195th Rifle Div. The normal corps artillery is supporting the divisions in contact. The unidentified mechanized rifle unit located in the vinicity * * * is estimated to be a mechanized riflo regiment and is believed to be in corps reserve. An estimated 1,200 guerrillas, lightly armed, are operating in the * * * area. At least one 300-mm gun battalion and one ROCKO and one MICKY missile battalion and elements of a howitzer division are known to be in support of Aggressor 22d Corps. Elements of the 4th Air Army have been supporting Aggressor forces in our sector.

c. Strength.

(1) Committed forces. 1st Corps is opposed by approximately seven rifle regiments and three medium tank regiments supported by 14 battalions of artillery, two antitank battalions, two 160-mm mortar battalions, one 240-mm rocket battalion, one 310-mm gun battalion, one ROCKO battalion, and one MICKY battalion. 1st Corps is also opposed by 1,200 guerrillas, lightly armed.

(2) Reinforcements, Aggressor reinforcements available for commitment in our Zone are--

(a) Estimated mechanized regiment located vicinity of * * *

* * * * * * *

(3) Air. 30th Army estimates there are 100 fighters, 50 attack, and 60 bomber aircraft within operational radius of our sector.

(4) Nuclear. One 310-mm gun battalion, one ROCKO battalion, and one MICKY battalion are estimated to be able to fire into our sector. 30th Army estimates that Aggressor can employ 30 nuclear weapons per month of from 0.5 KT to 500 KT yield within the Army area.

d. Recent and present significant activities. Annex A, Situation Overlay.

(1) During the period 3 to 8 Aug. Aggressor continued to fall back before the advance of 30th (US) Army until the line * * * was reached. Thereafter, aggressor resisted our advance successfully.

(2) Photo interpretation reports indicate extensive entrenchments being dug in the area between * * *. Civilian line crossers report that much of this is being done by forced civilian labor under Aggressor engineer supervision.

* * * * * * *

e. Peculiarities and weaknesses.

(1) Personnel. Aggressor units opposing US units are operating at about 70 per cent personnel strength. Combat efficiency is fair. Although losses received in operations west of the YANGTO River and in our nuclear attack along the YANGTO River were severe, Aggressor has been able to provide trained replacements on a limited scale. Morale is rated as fair to poor. This is evidenced by the high desertion rate and interrogation of prisoners of war.

(2) Intelligence. Aggressor radio and camouflage discipline appear to be weakening.

(3) Operations. All Aggressor divisions in contact are overextended. Aggressor forces opposing us do not have normal amount of supporting antitank, antiaircraft, and field artillery. His close air support is decreasing materially. Targets attacked with nuclear fires have been of battle group or larger size.

(4) Logistics. Aggressor can support a defensive operation and, with difficulty, an offensive operation. Aggressor is estimated to be short 30 per cent of his organic transportation and short of normal POL supplies. Thus, shortage may reduce Aggressor's capability to move his reserves rapidly.

(5) Personalities. General of Corps Carlos Torres has recently arrived in the theater and has assumed command of 22d Rifle Corps. He is reputed to be an expert on defensive operations.

4. ENEMY CAPABILITIES
   a. Enumeration.
      (1) Attack now along our front with seven rifle regiments supported by all available artillery, air, and nuclear weapons.
      (2) Defend now in present positions with seven rifle regiments supported by all available artillery, air, and nuclear weapons.
      (3) Reinforce his attack or defense with all or part of the following units at the places and times indicated:

UNIT	PLACE	MOTOR
* *	*	*
(b) Estimated mechanized regt vicinity * * *	* * *	2 hours and 10 minutes after start of movement
	* * *	3 hours after start of movement

*   *   *   *   *   *   *

      (7) Employ in the 1st Corps area an unknown number of nuclear weapon of 0.5 KT to 500 KT yield with delivery by artillery, free rocket, missile or air.
      (8) By massing aircraft within operational radius of 1st Corps, mount a maximum of * * * sorties daily.
   b. Analysis and discussion.
      (1) Attack. There are no indications of Aggressor adopting this capability.
      (2) Defend. The following indications point to Aggressor's adoption of the defense capability:

*   *   *   *   *   *   *

      (3) Aggressor nuclear attack is a continuing threat. It must be assumed that Aggressor will continue to employ nuclear weapons against targets of battle group or larger size.

*   *   *   *   *   *   *

      (8) Air attack is a continuing threat. However, it is unlikely that more than a small portion of Aggressor's air capability will be used for direct ground support.

5. CONCLUSIONS
   a. Our best defensive position is in the area * * *. The best avenue of approach to this area is * **. The best avenue of approach for an attack is * * *. Our use of smoke, toxic chemicals, nuclear weapons, fallout, air, armor, and artillery in the defense is favored by the characteristics of the area.
   b. Probable course of action. Defend in present position reinforced by available reserves and utilizing all available artillery, air, and nuclear weapons and continue harassing attacks with guerrilla forces.

(Classification)

c. Vulnerabilities.
   (1) Enemy vulnerable to penetration due to overextension of forces in contact.
   (2) Reduced ability to move reserves rapidly.

/s/Bravo
BRAVO
G2

Annex A--Situation Overlay (omitted)
Distribution--A

Extracted from FM 101-5 "Staff Officers Field Manual Staff Organization & Procedure", U. S. Department of the Army, Washington, D. C. Date 4 July, 1960. pgs. 208-13.

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BIOGRAPHIC NOTE

Major John Morton Fitzgerald II was born August 19, 1934, in New York City. He travelled extensively throughout his youth since his father, Herbert, was a career Army officer who retired in the grade of Colonel in 1957. While attending high school in the Republic of the Philippines, he served as a merchant seaman during summer vacations. As such he was present in China during the period of Communist takeover in 1948. Returning to the United States in 1949, Major Fitzgerald graduated from Fort Hamilton High School, Brooklyn, New York, in 1951. Following graduation, he served as a merchant seaman in Europe, an enlisted man in the U. S. Army, and for one year as a Cadet, U. S. Military Academy before entering the University of Pittsburgh in 1953 and graduating with a Bachelor of Arts (cum laude) Degree in Honors History in 1955. He earned the Master of Business Administration Degree from the Wharton School of Finance and Commerce, University of Pennsylvania in 1969.

Major Fitzgerald was commissioned Second Lieutenant of Artillery, U. S. Army Reserve, in August, 1955 and reentered active serivce in November. He was integrated into the Regular Service in March, 1958 as a 1st Lieutenant of Transportation Corps and he transferred to the Military Intelligence Branch shortly after its formation in 1963. His early assignments in the continental United States and Alaska included Artillery Battery, Armored Carrier Company, and Amphibious Boat Company Commands, and both intelligence, and personnel administration staff positions.

He is a graduate of the Army Intelligence School, the Naval Amphibious Intelligence School, and the Defense Intelligence School. In 1963-64 he served as Senior Advisor to the River and Lake Forces of the Republic of Bolivia, and in 1965 he performed a developmental river survey in Northern Peru. From November, 1966 through November, 1967, he served as I Corps Current Intelligence Analyst for the Assistant Chief of Staff, J-2, Military Assistance Command Viet Nam. He is currently assigned to the U. S. Marine Corps Command and Staff College, Quantico, Virginia.

Major Fitzgerald is a member of Phi Alpha Theta, Scabbard & Blade, Delta Sigma Phi, and the West Point Association. His decorations include the Legion of Merit and the Army Commendation Medal with oak leaf cluster.

Major Fitzgerald married the former Marienne Elizabeth Moren, of Bethel Park, Pennsylvania, in November, 1955. They have three children; Sheryl Ann, born in July, 1956, John M. III, born in October, 1958, and Kelly Lee, born in March, 1961.